BRAMPTON
Flower City
brampton.ca

CITY OF BRAMPTON TRANSPORTATION MASTER PLAN UPDATE

TECHNICAL REPORT #2 - 2041 ROAD NETWORK

AUGUST 2015

MMM GROUP

Table of Contents

List of Figures

List of Tables

Appendices

1. INTRODUCTION

This report documents the transportation modelling and analysis process undertaken to arrive at the recommended 2041 road network. The report builds upon the model calibration and validation work that was described in Technical Report #1. The report includes the analysis of existing conditions as well as the analysis of seven different alternatives for the year 2041. The purpose of this Technical Report #2 is to provide sufficient information to trace the analysis that led to the recommendation of the preferred 2041 road network.

2. CURRENT TRAVEL DEMAND

The City's EMME travel demand forecasting model was used to analyze existing (year 2011) and ultimate year (year 2041) travel conditions in the p.m. peak hour. The calibration and validation process to prepare the model for forecasting is detailed in Technical Report #1 – Model Validation.

While it is recognized that there are heavy traffic volumes on select roads in the city during the p.m. peak hour, the analysis of screenlines shows generally adequate capacity in the peak northbound and westbound directions in the p.m. peak hour. One screenline that is beginning to show capacity concerns is the northbound screenline at Highway 410 and Bovaird Drive. This reflects the commuter traffic returning home from work. The screenline analyses of year 2011 traffic conditions in the p.m. peak hour are shown in **Figure 1** and **Figure 2**.

Five overarching evaluation accounts were selected for use in the analysis of existing and future conditions, including:

- Integrated land use and transportation planning;
- Environmental consciousness;
- Economic viability;
- Mobility; and
- Energy efficient transportation system.

Metrics were taken from the travel demand model, with the results for the p.m. peak hour reported in **Table 1**.

The metrics show considerable travel on roads in Brampton, with average auto trip times of slightly less than 30 minutes. Kilometres traveled in congestion are estimated at 17%, and 20% of those traveling during the peak hour are stuck in traffic. 6% of the trips are on Brampton Transit (either local service or ZÜM).

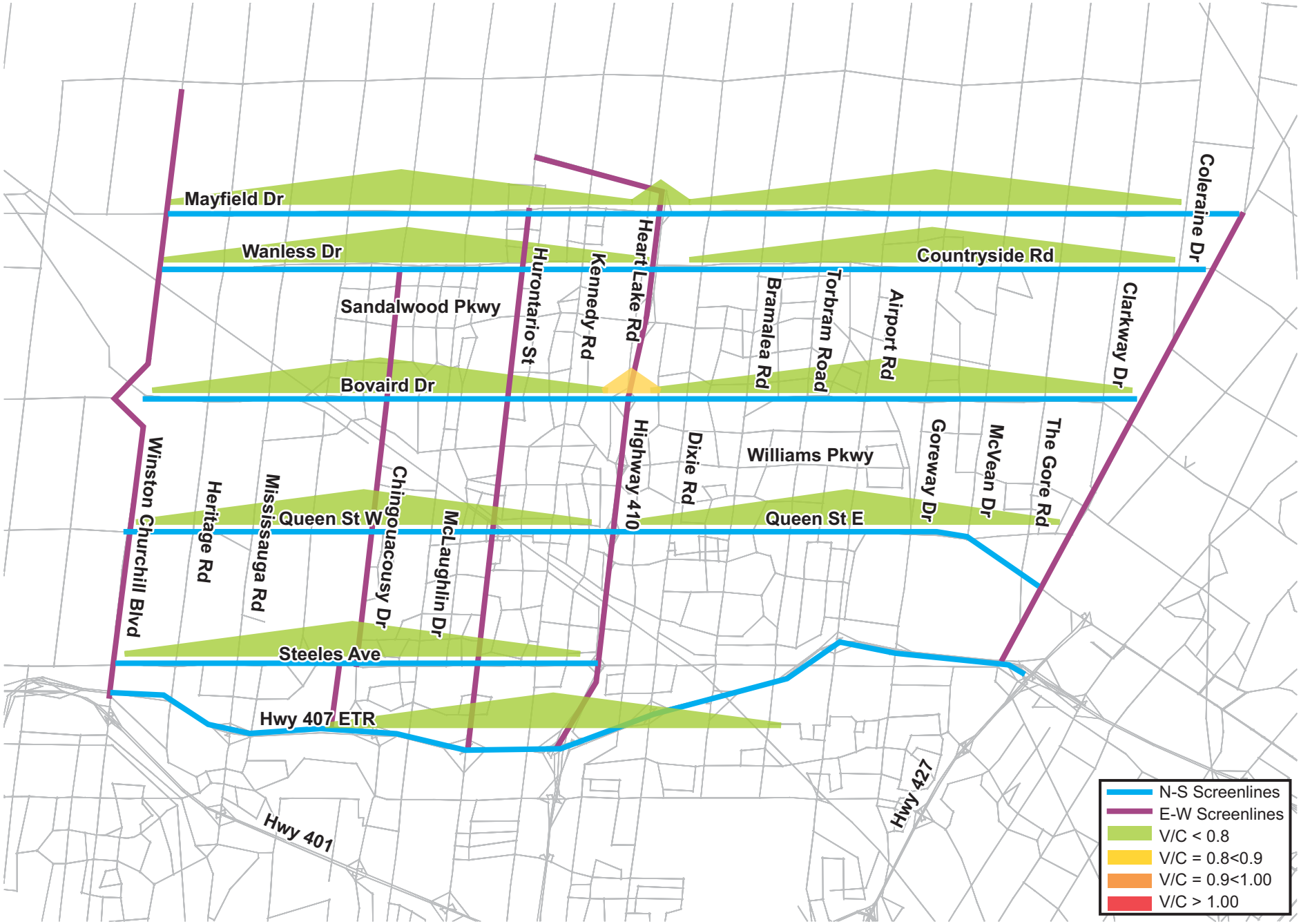


Figure 1 - Screenline Analysis of Existing (Year 2011) Conditions - Northbound, P.M. Peak Hour

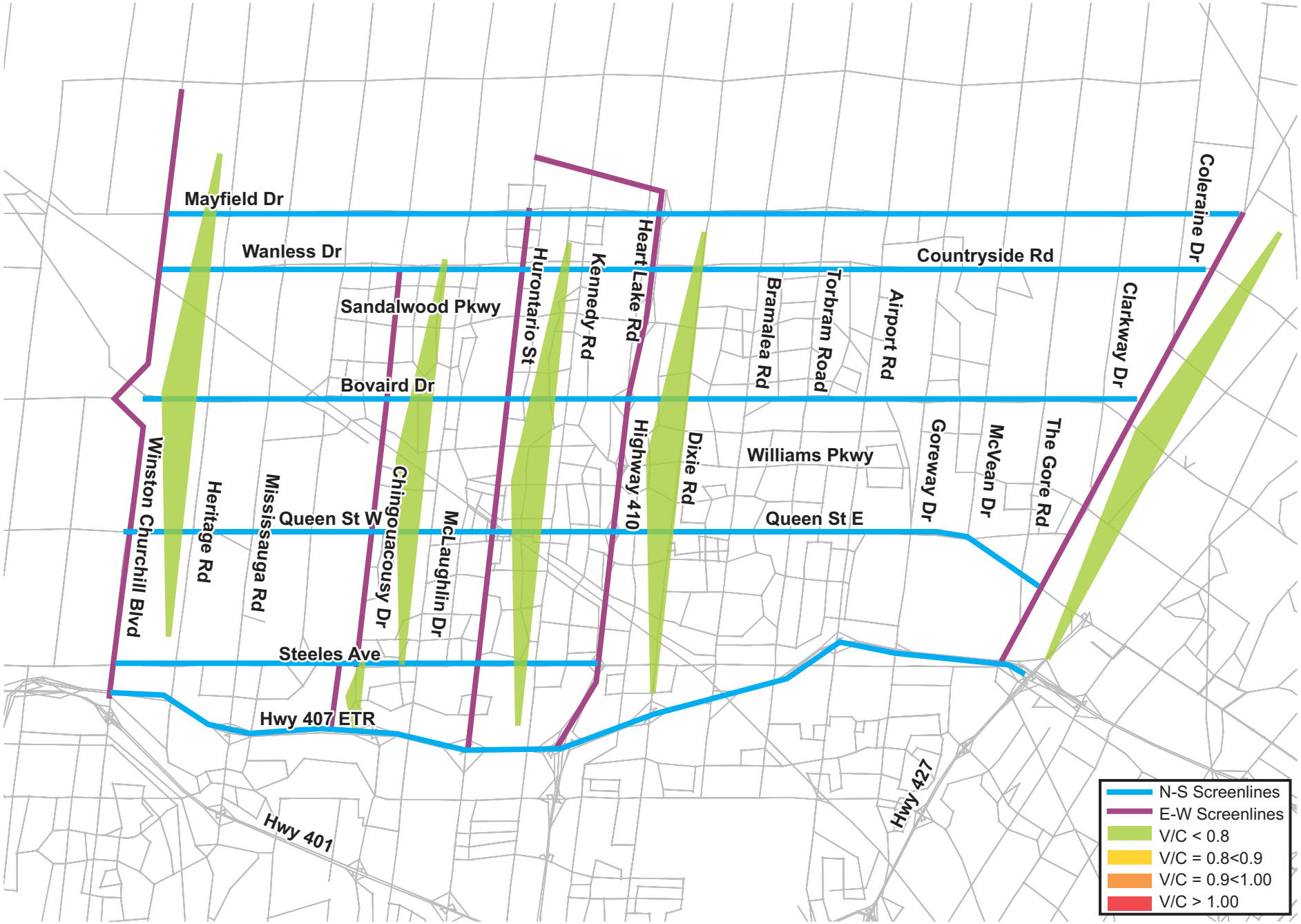


Figure 2 - Screenline Analysis of Existing (Year 2011) Conditions - Westbound, P.M. Peak Hour

Table 1: Analysis of Existing Conditions (Year 2011) Model Results

Evaluation Accounts	Metrics	2011 Results
Integrated Land Use and Transportation Planning	Average Auto Times (min)	27
	Average Transit Times per Ride (min)	11
Environmental Consciousness	% of Congested VKT	17%
	% of Congested VHT	20%
Economic Viability	% of Congested Roads (lane-kms)	8%
	Travel Time Index (congested / free flow)	1.32
	Annual Delay Cost of Congestion	$342 Million
	Lane-kms per 1,000 people	4.66
	Modal Split (City-wide / ZÜM)	6%
Mobility	Annual Transit Rides per Capita	52
	Transit Boardings (peak period)	42,743
	Boardings over 75% of Line Capacity	45%
Energy Efficient Transportation System	Daily VKT	10,195,670
	Daily VHT	192,790

3. FORECASTING FUTURE TRAVEL DEMAND

An understanding of the current travel conditions provides a basis for forecasting future travel demand to the year 2041. The City's forecast population and employment data for the year 2041 exhibit rapid growth, as shown in **Table 2**. These forecasts were used in the travel demand model to develop transportation alternatives for the ultimate year 2041 horizon.

Table 2: Brampton's Forecast Population and Employment Growth

	2011	2016	2021	2026	2031	2041
Population	523,900	627,500	701,600	771,300	842,800	899,500
Employment	182,000	207,800	238,100	264,000	291,400	325,200

Source: City of Brampton, TAZ projections (population and employment) and Economic Development

To begin the year 2041 analysis, a "Do Nothing" alternative was analyzed. Alternative 1: Do Nothing assumes that forecast population and employment occurs but that no further investment in transportation infrastructure takes place. This alternative is analyzed in order to establish a foundation for comparison purposes and to identify areas where the existing road network may not be able to accommodate forecast future volumes; indicating some type of improvements should be considered.

The same evaluation accounts and metrics used in the existing conditions analysis were used again to analyze the 2041 Do Nothing alternative. The screenline analyses are shown in **Figure 3** and **Figure 4**, with the metrics reporting for the p.m. peak hour tallied in **Table 3**.

Table 3: Analysis of Alternative 1: Do Nothing Model Results

Evaluation Accounts	Metrics	Alternative 1: Do Nothing
Integrated Land Use and Transportation Planning	Average Auto Times (min)	82
	Average Transit Times per Ride (min)	12
Environmental Consciousness	% of Congested VKT	65%
	% of Congested VHT	79%
Economic Viability	% of Congested Roads (lane-kms)	47%
	Annual Delay Cost of Congestion	$ 2.06 Billion

Evaluation Accounts	Metrics	Alternative 1: Do Nothing
	Lane-kms per 1,000 people	2.64
	Modal Split (City-wide / ZÜM)	6%
Mobility	Annual Transit Rides per Capita	48
	Transit Boardings (peak period)	68,878
	Boardings over 75% of Line Capacity	47%
Energy Efficient Transportation System	Daily VKT	17,328,150
	Daily VHT	583,240

If population and employment increase as forecast by 2041 and no investment is made to the transportation network, there will be serious ramifications for travel times and costs of congestion. Under this alternative, average auto trip times would skyrocket from 27 minutes presently to 82 minutes. The percentage of travel on congested lanes would rise from 17% today to 65%. The annual cost of congestion would exceed $2 billion. Clearly, transportation investment is needed to keep Brampton moving.

The screenline analysis reiterates these findings, with multiple screenlines above capacity in the p.m. peak hour in the northbound and westbound directions. All westbound screenlines would be expected to have a volume to capacity ratio of 0.9 or higher. Northbound screenlines along Highway 410 would be expected to be over capacity and northbound screenlines north of Bovaird Drive, Queen Street and Steeles Avenue also are forecast to be over capacity.

The existing transportation system in Brampton does not have adequate capacity to accommodate forecast growth in population and employment when considering likely travel patterns in the p.m. peak hour. Additional investment in transportation infrastructure is required.

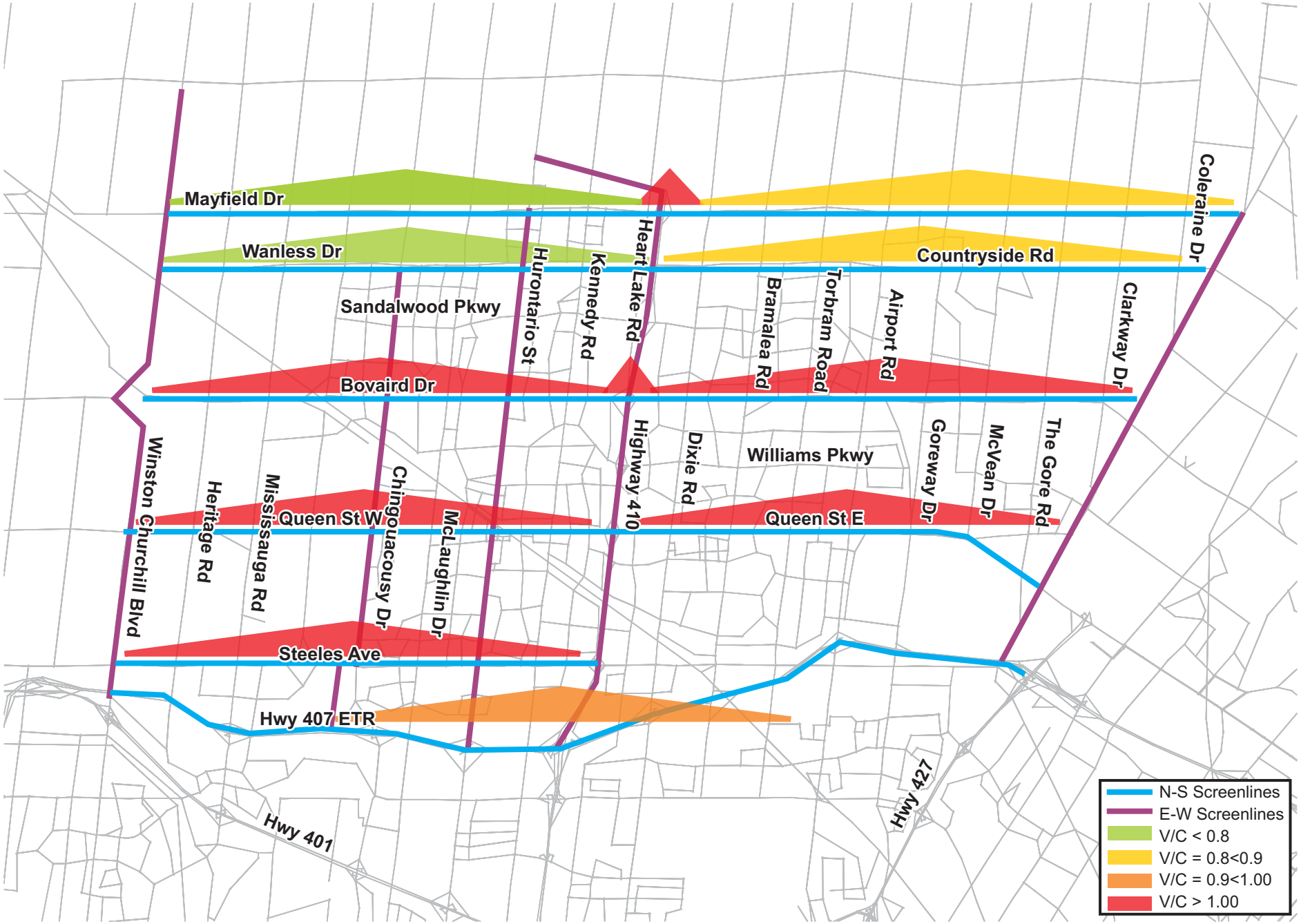


Figure 3 - Screenline Analysis of Alternative 1: Do Nothing - Northbound, P.M. Peak Hour

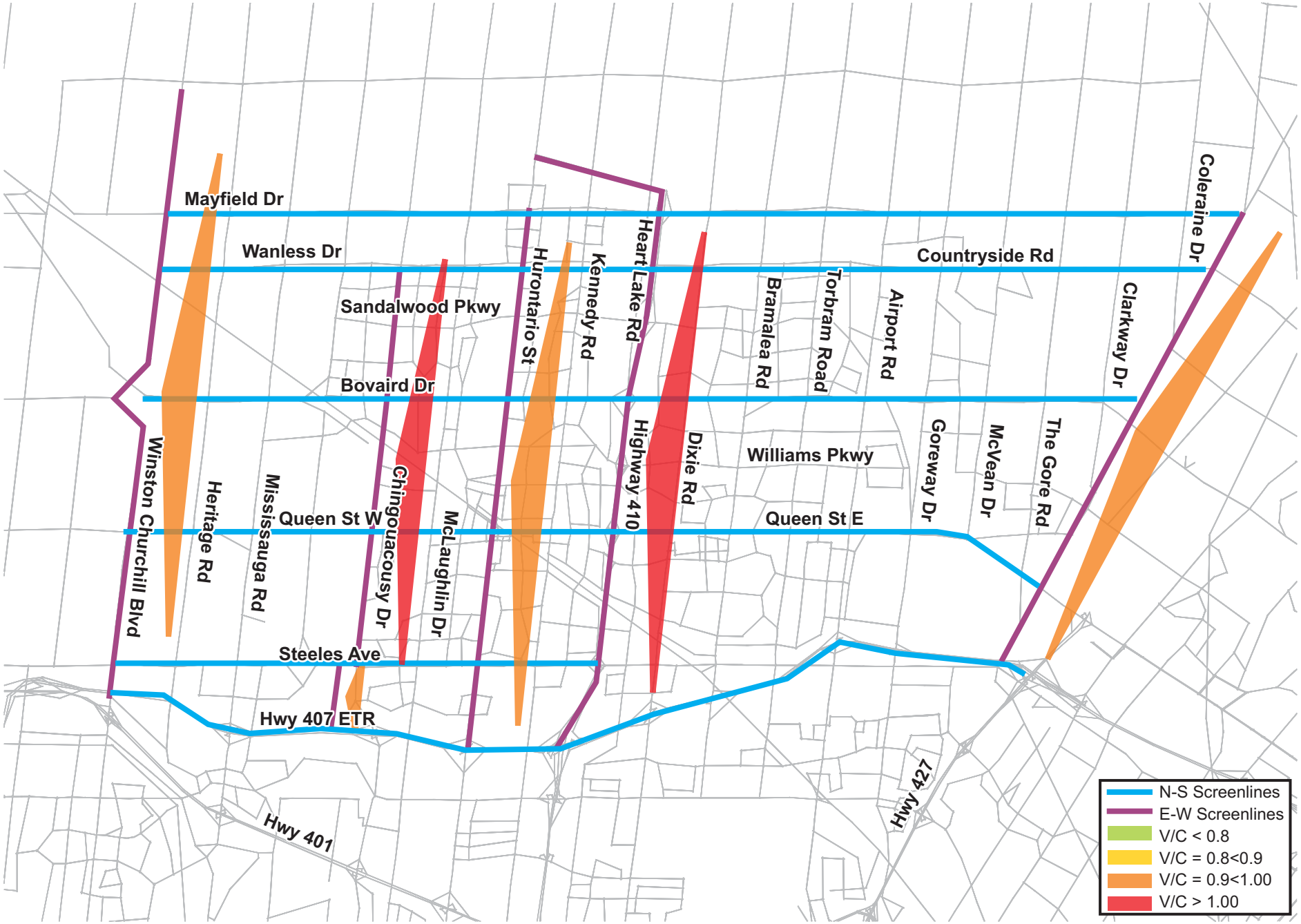


Figure 4 - Screenline Analysis of Alternative 1: Do Nothing - Westbound, P.M. Peak Hour

4. ALTERNATIVES GENERATION

The analysis of the Do Nothing alternative revealed that transportation improvements will need to be made to accommodate forecast growth in travel demand. An iterative process was undertaken to generate additional alternative 2041 road networks for analysis. In total, seven unique alternatives were assessed. The alternatives assessed included:

1. **Alternative 1: Do Nothing**: analyzed in the previous chapter, this alternative included no further transportation investment to the existing road network in Brampton. Population and employment numbers would grow, but no further transportation projects would be constructed.
2. **Alternative 2: Base Case**: The likelihood that absolutely no transportation improvements would be constructed to the year 2041 is low. A number of projects are included in the City's Capital Improvement Plan (CIP) and have funding identified for construction. These could be presumed to be constructed by 2041. This second alternative includes the existing road network with the projects listed in the CIP.
3. **Alternative 3: All Projects in the 2009 TTMP**: This current report is an update to the 2009 TTMP. The planned road network from the 2009 TTMP document was assessed for the year 2041, given the new population and employment forecasts, to determine whether or not it still meets transportation needs.
4. **Alternative 4: Modifications to Alternative 3**: A multiple account evaluation (MAE) framework was used to analyze the recommended improvements in the 2009 TTMP. Strategic modifications were made to this network based on the 2041 population and employment forecasts.

Additional Modifications to Alternative 3:

5. **Alternative 5: Consisting of Alternative 3 Plus New Projects (assuming a 16% local transit mode split)**: The prior alternatives (2, 3, and 4) did not include any new improvements outside of what was shown in the 2009 TTMP. Beginning with this alternative, additional road improvements were recommended to accommodate population and employment forecasts to the year 2041. This alternative assumed that local transit would account for 16% of peak hour trips.
6. **Alternative 6: Consisting of Alternative 3 Plus New Projects (assuming a 16% local transit mode split in dedicated lanes)**: Similar to the previous alternative, this alternative included new road improvements and assumed that the local transit mode split would reach 16%. Dedicated transit lanes on select roads in the city would be in place in order to help reach this local transit mode split goal.
7. **Alternative 7: Consisting of Alternative 3 Plus New Projects (assuming a 16% local transit mode split in mixed traffic)**: The final alternative considered a 16% mode split with local transit operating in mixed traffic. This alternative included considerable dialogue with City staff and building industry stakeholders to identify needed projects to support ongoing development. This alternative was developed concurrently with the Development Charges Study to coordinate TMP Update and Development Charges recommendations on the future road network.

5. ALTERNATIVES ASSESSMENT

5.1 Analysis of Initial 2041 Alternatives

The first four alternatives noted in Section 4 were analyzed in the travel demand model with the same evaluation accounts and metrics as were used to analyze existing conditions. The metrics for these four alternatives are shown in **Table 4**. Screenline analyses also were prepared for each alternative. These are included for the Alternative 2: Base Case (**Figure 5** and **Figure 6**), Alternative 3: 2009 TTMP (**Figure 7** and **Figure 8**) and Alternative 4: Modification to 2009 TTMP (**Figure 9** and **Figure 10**). The Alternative 1: Do Nothing metrics, previously reported in Section 3, are repeated here for comparison with the other alternatives. The Alternative 1 screenline analyses were presented in **Figure 3** and **Figure 4**.

Table 4: Metrics for Initial 2041 Alternatives

Evaluation Accounts	Metrics	Alternatives			
		Alternative 1: Do Nothing	Alternative 2: Base Case	Alternative 3: 2009 TTMP	Alternative 4: Modifications to 2009 TTMP
Integrated Land Use and Transportation Planning	Average Auto Times (min)	82	41	32	32
	Average Transit Times per Ride (min)	12	11	11	13
Environmental Consciousness	% of Congested VKT	65%	56%	33%	34%
	% of Congested VHT	79%	69%	44%	44%
Economic Viability	% of Congested Roads (lane-kms)	47%	36%	16%	18%
	Annual Delay Cost of Congestion	$2.06 Billion	$1.64 Billion	$987 Million	$935 Million

Evaluation Accounts	Metrics	Alternatives			
		Alternative 1: Do Nothing	Alternative 2: Base Case	Alternative 3: 2009 TTMP	Alternative 4: Modifications to 2009 TTMP
	Lane-kms per 1,000 people	2.64	3.05	3.59	3.59
	Modal Split (City-wide / ZÜM)	6%	6%	9%	9%
Mobility	Annual Transit Rides per Capita	48	52	83	79
	Transit Boardings (peak period)	68,878	74,123	118,932	113,794
	Boardings over 75% of Line Capacity	47%	52%	47%	48%
Energy Efficient Transportation System	Daily VKT	17,328,150	17,705,830	17,676,570	17,561,310
	Daily VHT	583,240	517,920	398,880	389,190

It is clear from the model results that additional transportation projects would have a positive impact on the evaluation accounts. The introduction of transportation projects would be expected to reduce auto travel times, reduce congestion, reduce the costs of congestion and reduce the amount of time spent travelling, when compared to the Do Nothing alternative. The progressive increase in investment from the Do Nothing alternative to the Base Case alternative and then on to two variations of the 2009 TTMP show a marked improvement in the evaluation metrics.

Transit metrics also improve in the alternative alternatives compared to the Do Nothing alternative. Rides per capita and transit boardings both are forecast to increase. In some alternatives, these increases lead to a higher modal split for transit.

The screenline analyses also show the positive impact on capacity that the transportation investments have. Alternative 2: Base Case alternative shows incremental improvement over the Do Nothing alternative, but still multiple screenlines in both the northbound and westbound directions are forecast to be approaching capacity or even over capacity. The current 10-year capital plan, while helpful, will not fully address long term transportation needs to the year 2041.

Testing the projects included in the 2009 TTMP (Alternative 3) with the 2041 population and employment forecasts showed a substantial improvement in screenline performance. The only screenline forecast to be over capacity in this alternative is the northbound screenline at Bovaird Drive and Highway 410. Screenlines in the southern and central portion of the city would be expected to show volumes approaching capacity.

While Alternative 4 includes different projects compared to the 2009 TTMP, on a screenline level, the analysis shows the same colour band display, with the difference in projects not affecting the classification of the screenlines.

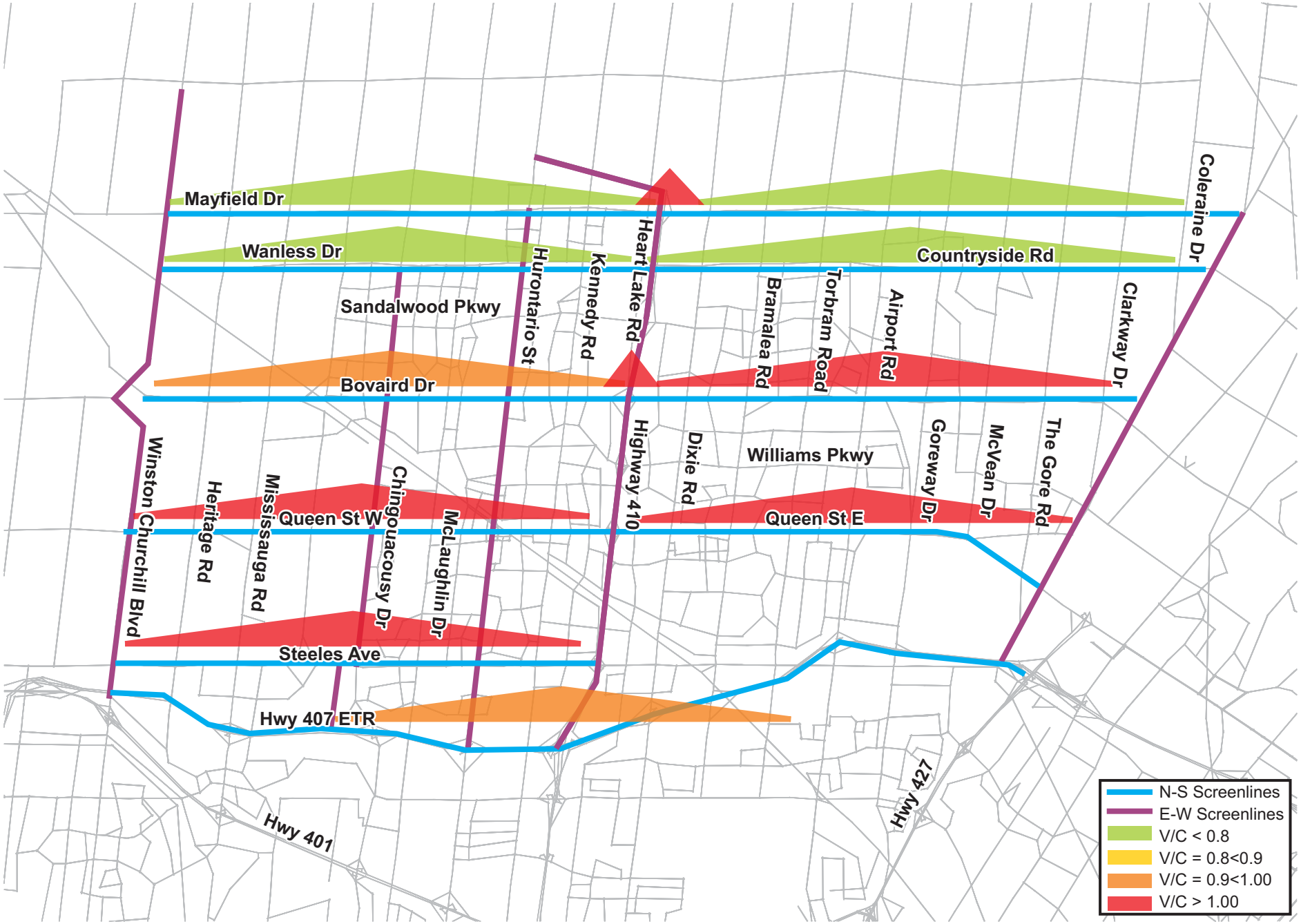


Figure 5 - Screenline Analysis of Alternative 2: Base Case - Northbound, P.M. Peak Hour

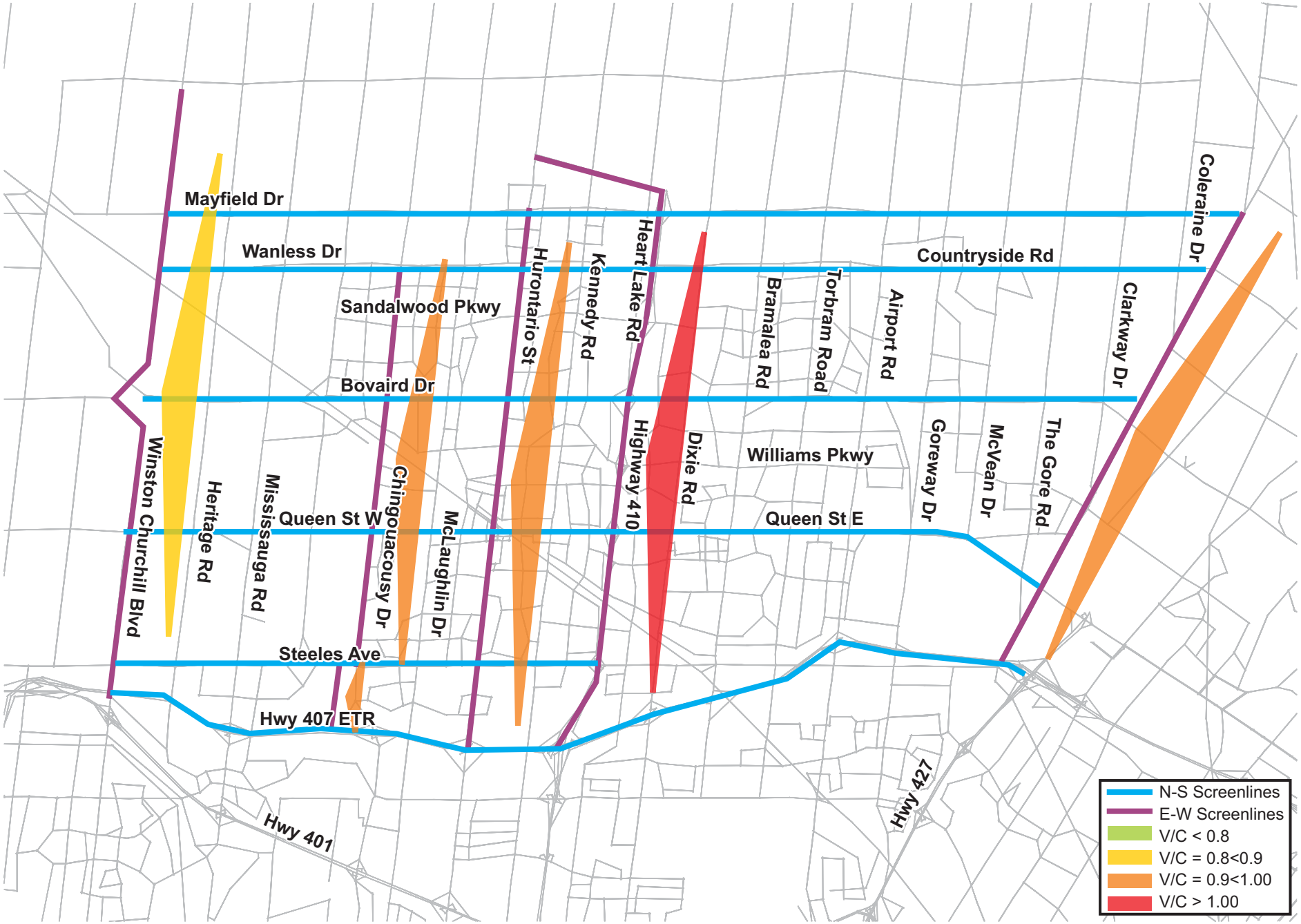


Figure 6 - Screenline Analysis of Alternative 2: Base Case - Westbound, P.M. Peak Hour

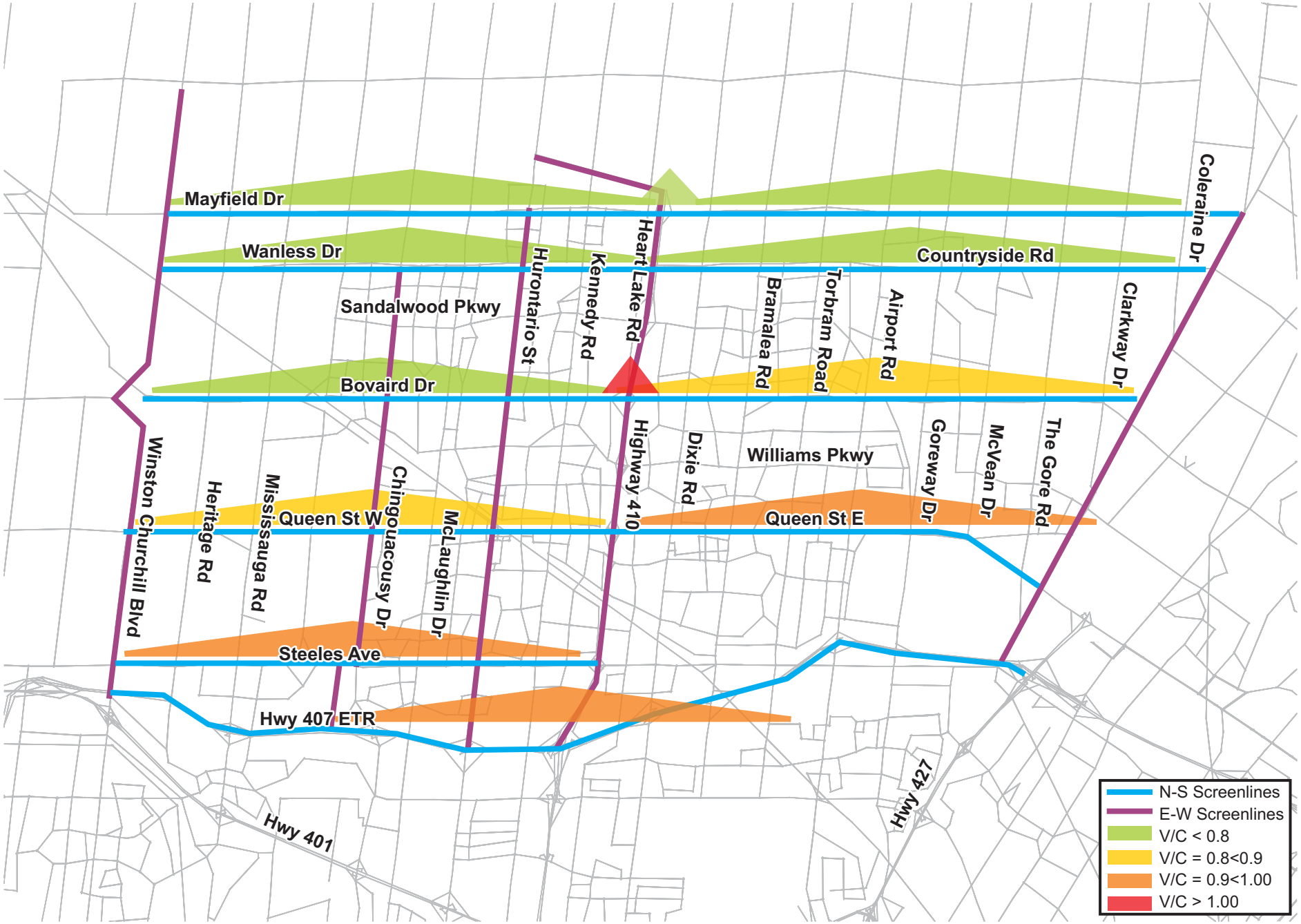


Figure 7 - Screenline Analysis of Alternative 3: 2009 TTMP - Northbound, P.M. Peak Hour

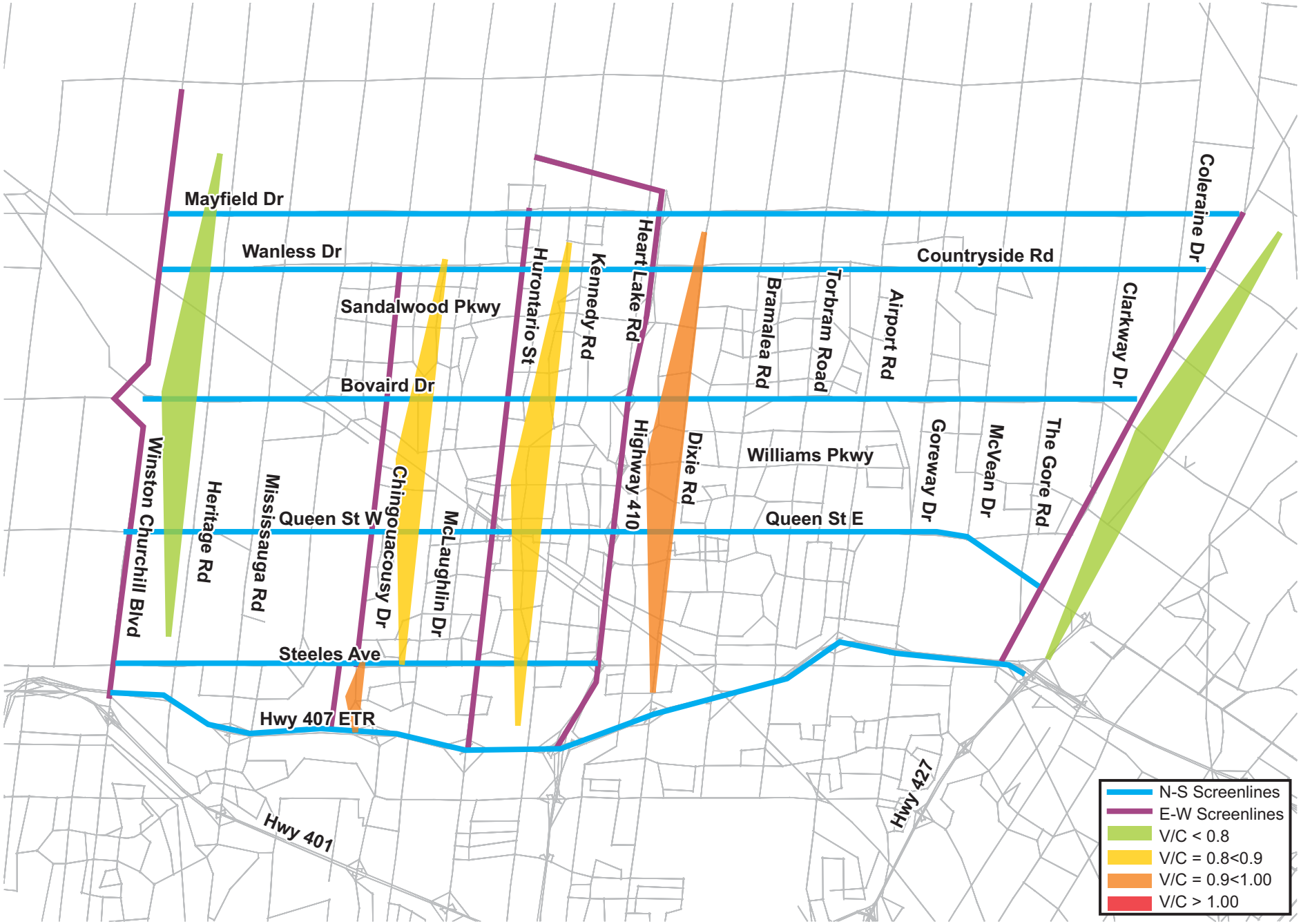


Figure 8 - Screenline Analysis of Alternative 3: 2009 TTMP - Westbound, P.M. Peak Hour

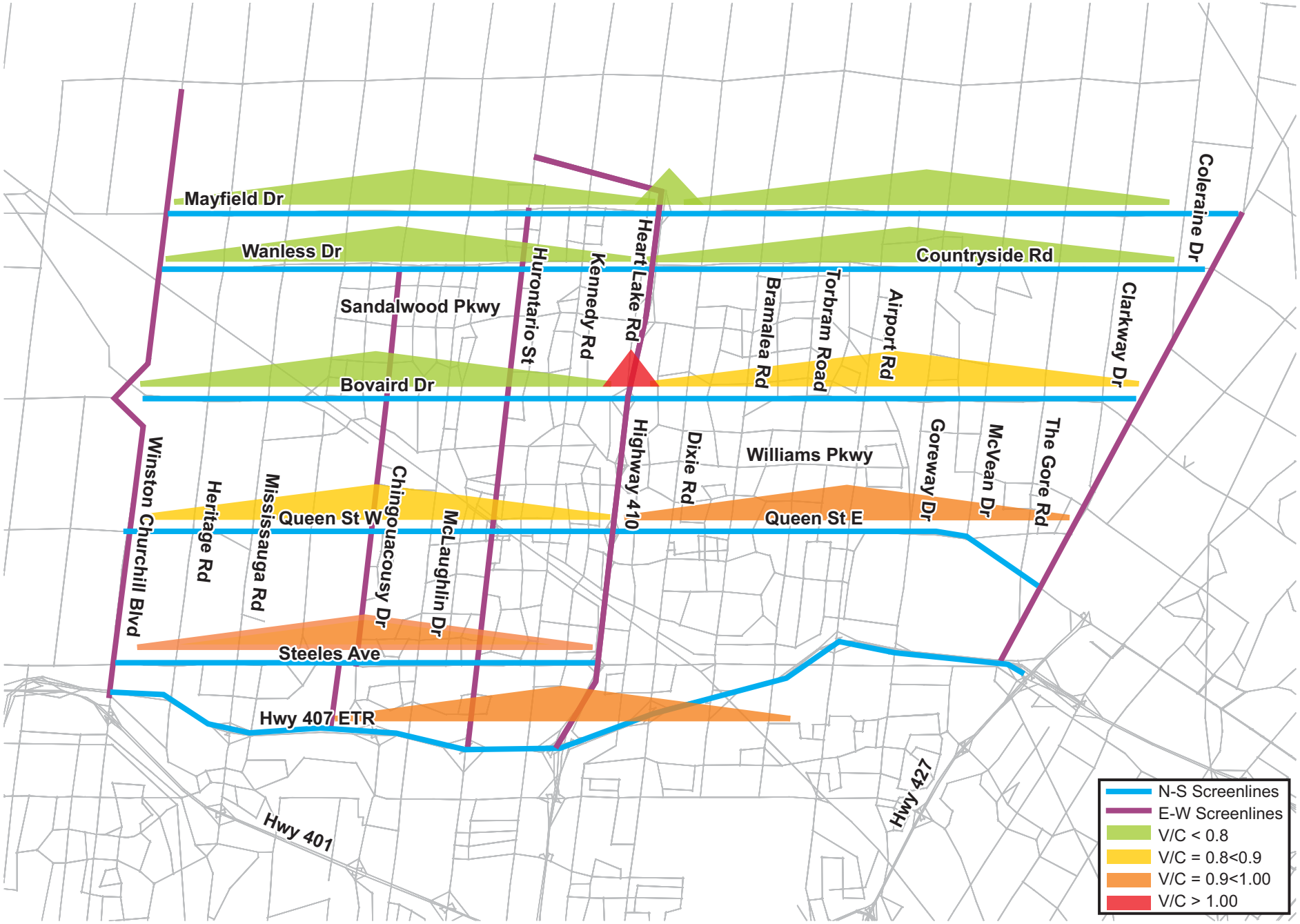


Figure 9 - Screenline Analysis of Alternative 4: Modifications to 2009 TTMP - Northbound, P.M. Peak Hour

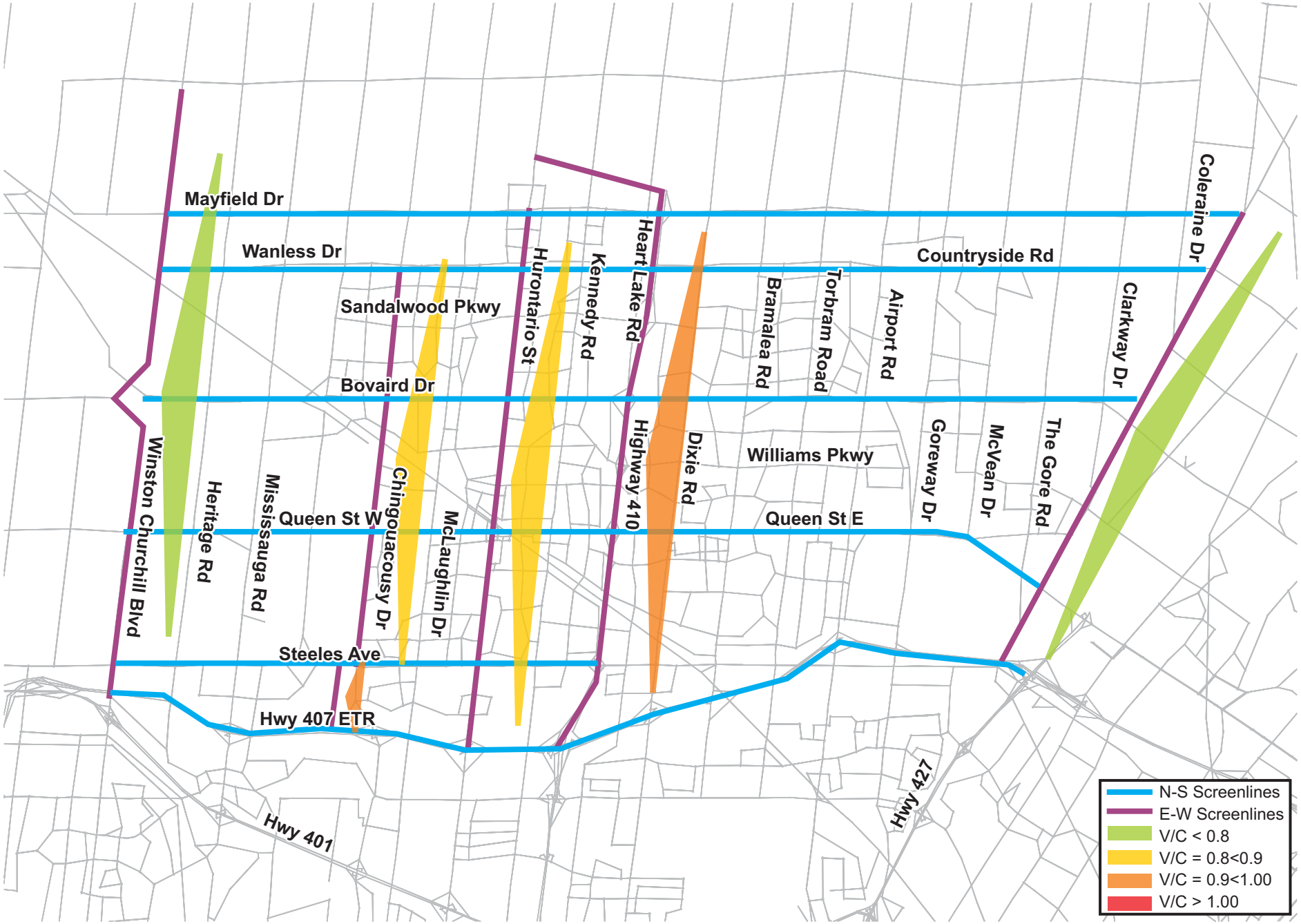


Figure 10 - Screenline Analysis of Alternative 4: Modifications to 2009 TTMP - Westbound, P.M. Peak Hour

5.2 Refinements to Help Determine a Preferred Alternative

After analyzing the first four alternatives, the question turned to whether or not these alternatives would be sufficient to meet the City's needs to the year 2041. The analysis of screenlines had shown areas where volumes would be expected to approach capacity in the southern and central portions of the city. The previous alternatives included road projects that had been planned based on 2031 population and employment projections. With another ten years of forecast population and employment growth added, additional road improvements were considered for the year 2041.

With all of these criteria and factors in mind, the final three alternatives considered what projects would be needed in addition to those identified in the 2009 TTMP. Rather than try to rationalize each and every project in the 2009 TTMP, the 2009 TTMP projects were accepted as valid and any additional projects were identified.

Alternative 6 considered a 10% local transit mode split. This goal for local transit did not fit with the City's vision of a multi-modal transportation network or Brampton Transit's plans to increase service to meet the City's vision. Alternative 7 then was tested with a 16% mode split for local transit, with transit operating in dedicated transit lanes on select arterial roads.

No lanes presently operate in the City as transit only, so a final alternative, Alternative 7, was devised to set as a goal a 16% local transit mode split with transit operating in mixed use lanes. It was understood that achieving this transit goal would be more difficult in mixed use lanes than in transit-only lanes. A decision to convert any arterial lanes from mixed traffic lanes to dedicated transit lanes was postponed to the future, when the appropriate policies are in place at the City-level. The evaluation accounts and metrics for these final three alternatives are presented in **Table 5**. Screenline analyses of the p.m. peak hour are presented for Alternative 5 (**Figure 11** and **Figure 12**), Alternative 6 (**Figure 13** and **Figure 14**) and Alternative 7 (**Figure 15** and **Figure 16**).

Table 5: Evaluation of Final Three Alternatives, P.M. Peak Hour

Evaluation Accounts	Metrics	Alternative 5: Alternative 3 Plus New Projects (assuming a 16% local transit mode split)	Alternative 6: Alternative 3 Plus New Projects (assuming a 16% local transit mode split in dedicated lanes)	Alternative 7: Alternative 3 Plus New Projects (assuming a 16% local transit mode split in mixed traffic)
Integrated Land Use and Transportation Planning	Average Auto Times (min)	32	30	31
	Average Transit Times per Ride (min)	10	11	13
Environmental Consciousness	% of Congested VKT	28%	31%	29%
	% of Congested VHT	34%	41%	37%
Economic Viability	% of Congested Roads (lane-kms)	12%	14%	14%
	Annual Delay Cost of Congestion	$728 Million	$860 Million	$757 Million
	Lane-kms per 1,000 people	3.59	3.45	3.62
	Modal Split (City-wide / ZÜM)	16%	16%	16%
Mobility	Annual Transit Rides per Capita	124	121	117

Evaluation Accounts	Metrics	Alternative 5: Alternative 3 Plus New Projects (assuming a 16% local transit mode split)	Alternative 6: Alternative 3 Plus New Projects (assuming a 16% local transit mode split in dedicated lanes)	Alternative 7: Alternative 3 Plus New Projects (assuming a 16% local transit mode split in mixed traffic)
	Transit Boardings (peak period)	178,045	174,154	169,100
	Boardings over 75% of Line Capacity	63%	61%	62%
Energy Efficient Transportation System	Daily VKT	16,693,750	16,522,650	16,661,940
	Daily VHT	340,980	361,600	345,460

Additional transportation projects would be expected to further reduce travel times, congestion and the costs of congestion plus help address capacity concerns on congested screenlines. A strong policy as well as infrastructure investments for transit will be needed to achieve the 16% mode split for Brampton Transit. Doing so would be expected to result in increased ridership. Overall, these final three alternatives best address the evaluation accounts of integrated land use and transportation planning, environmental consciousness, economic viability, mobility and an energy efficient transportation system.

The analysis on the screenline level of these three alternatives shows similar results. The westbound screenline at Chinguacousy Drive shows improvement in Alternatives 5 and 7, compared to Alternative 6. All other westbound as well as northbound screenlines are the same for these three alternatives, with the differences in the projects not affecting traffic volumes so much that the colour band changes in the screenline analysis.

There are no screenlines forecast to be over capacity in any of the final three alternatives. Improvements in capacity are noticeable on the northbound screenlines at Steeles Avenue and Queen Street West, when compared to the 2009 TTMP alternative.

The goal of the TMP Update is not to achieve a screenline analysis where every screenline is green but instead to make strategic multi-modal transportation investments to keep traffic moving in the city in light of forecast rapid population and employment growth and the realities of budget constraints. The final three alternatives represent a plausible future that would achieve this goal.

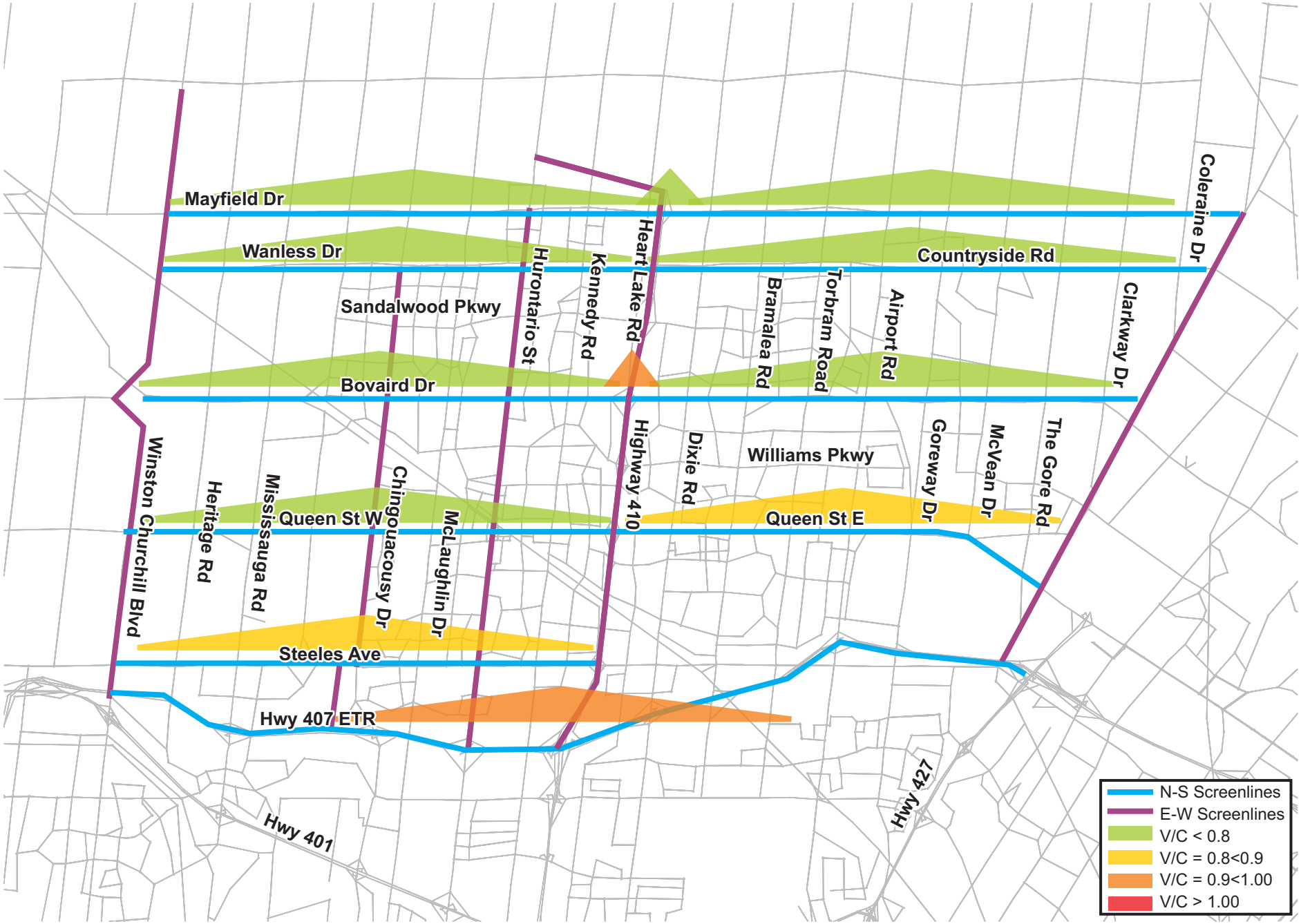


Figure 11 - Screenline Analysis of Alternative 5 - Northbound, P.M. Peak Hour

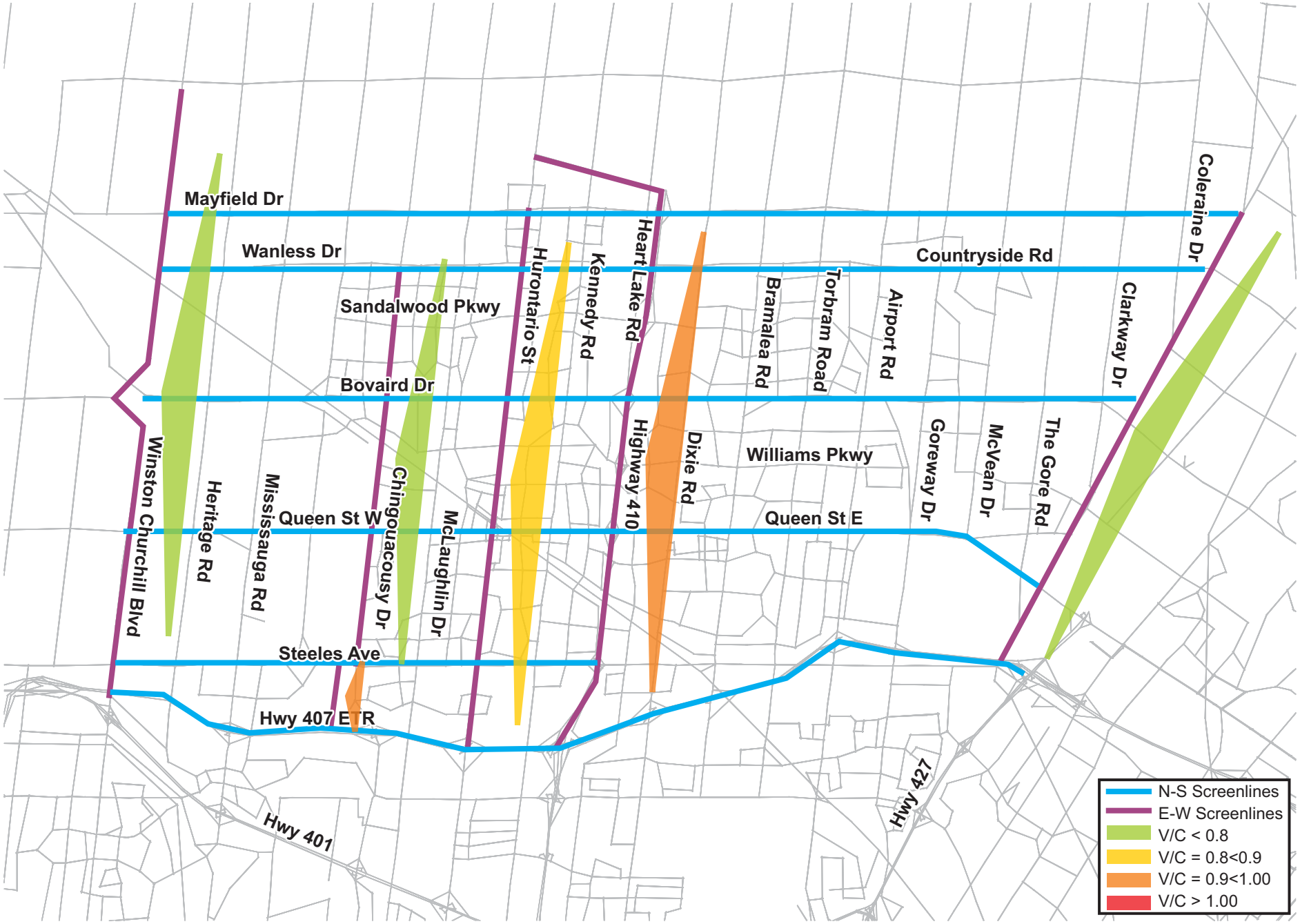


Figure 12 - Screenline Analysis of Alternative 5 - Westbound, P.M. Peak Hour

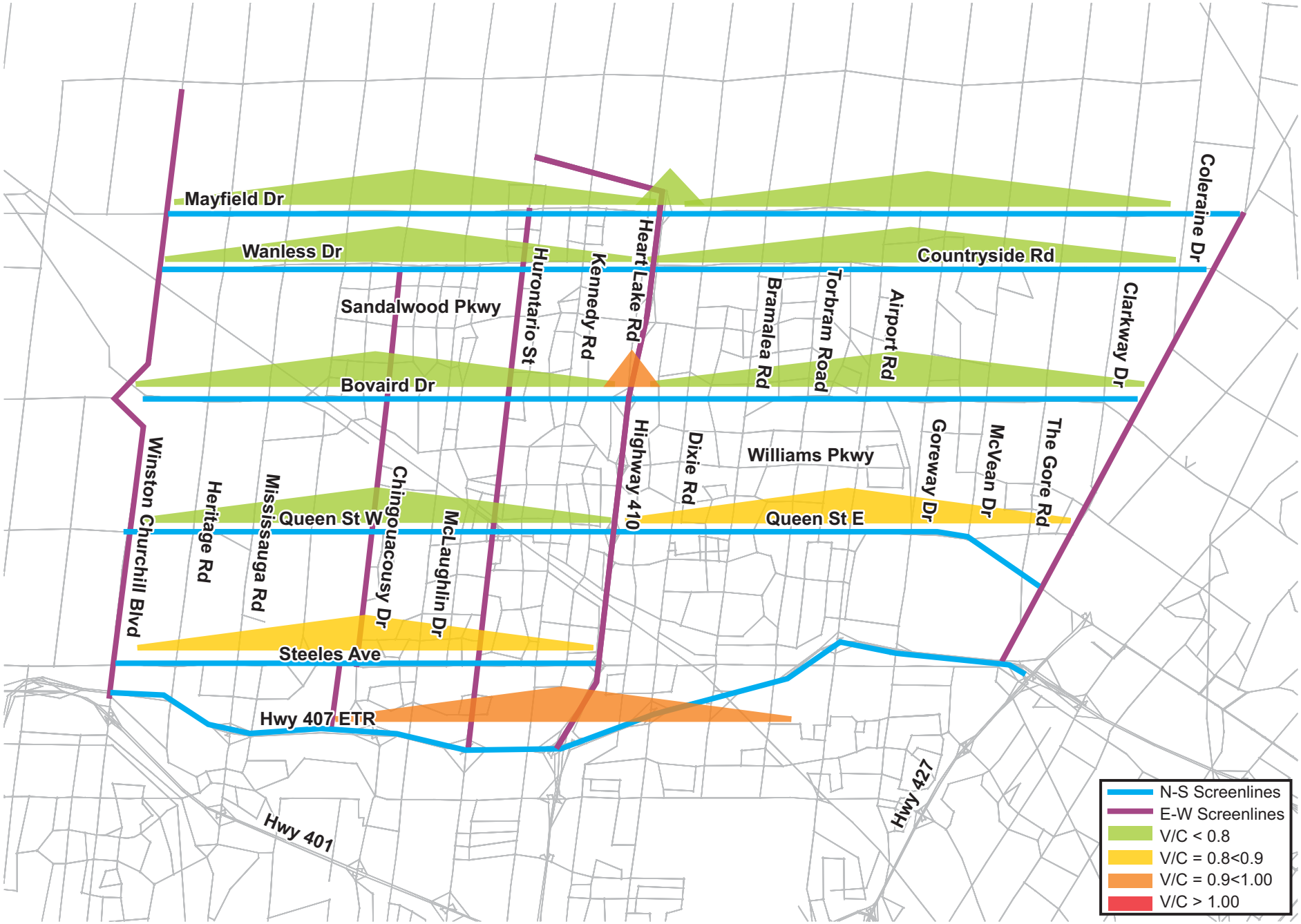


Figure 13 - Screenline Analysis of Alternative 6 - Northbound, P.M. Peak Hour

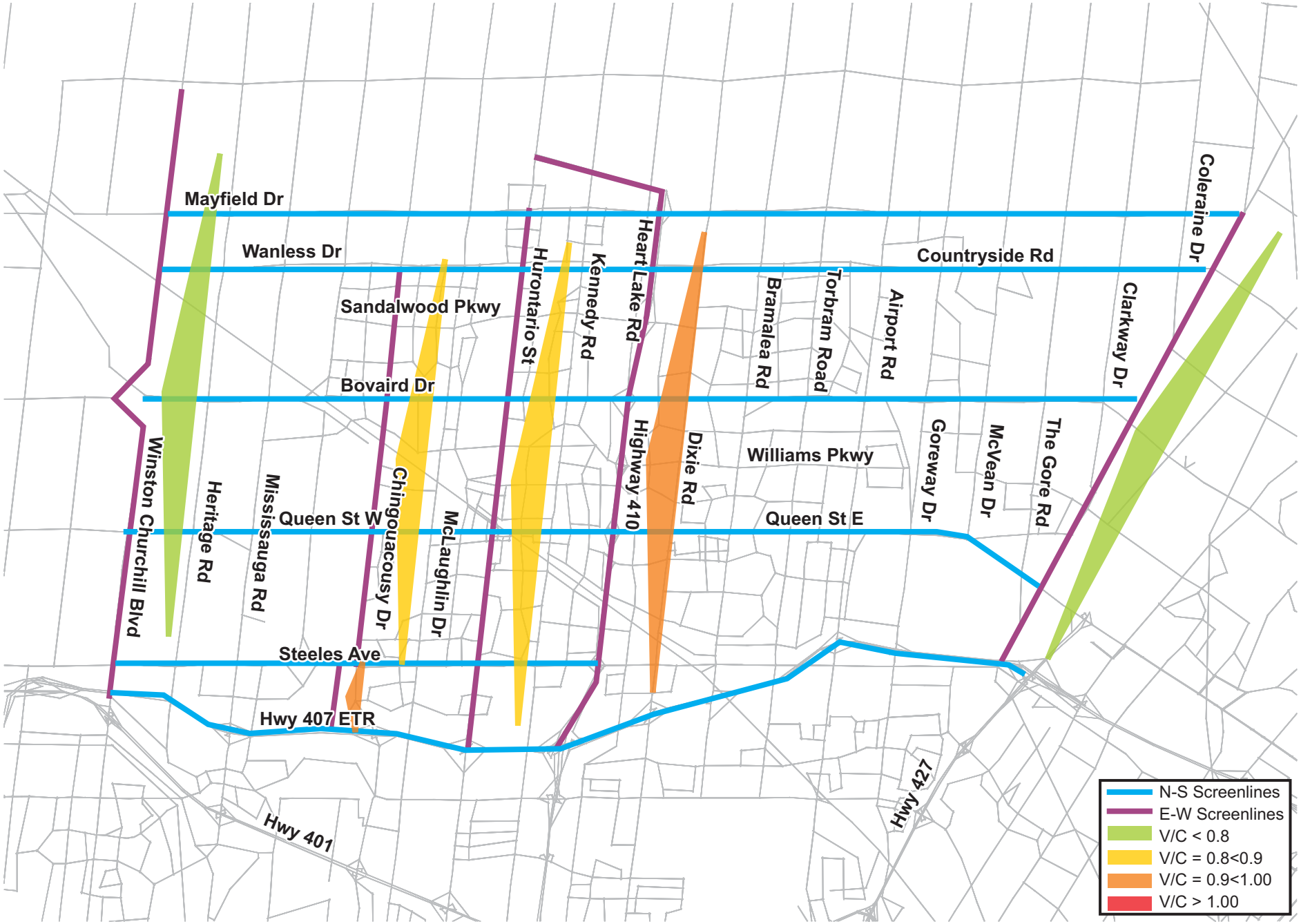


Figure 14 - Screenline Analysis of Alternative 6 - Westbound, P.M. Peak Hour

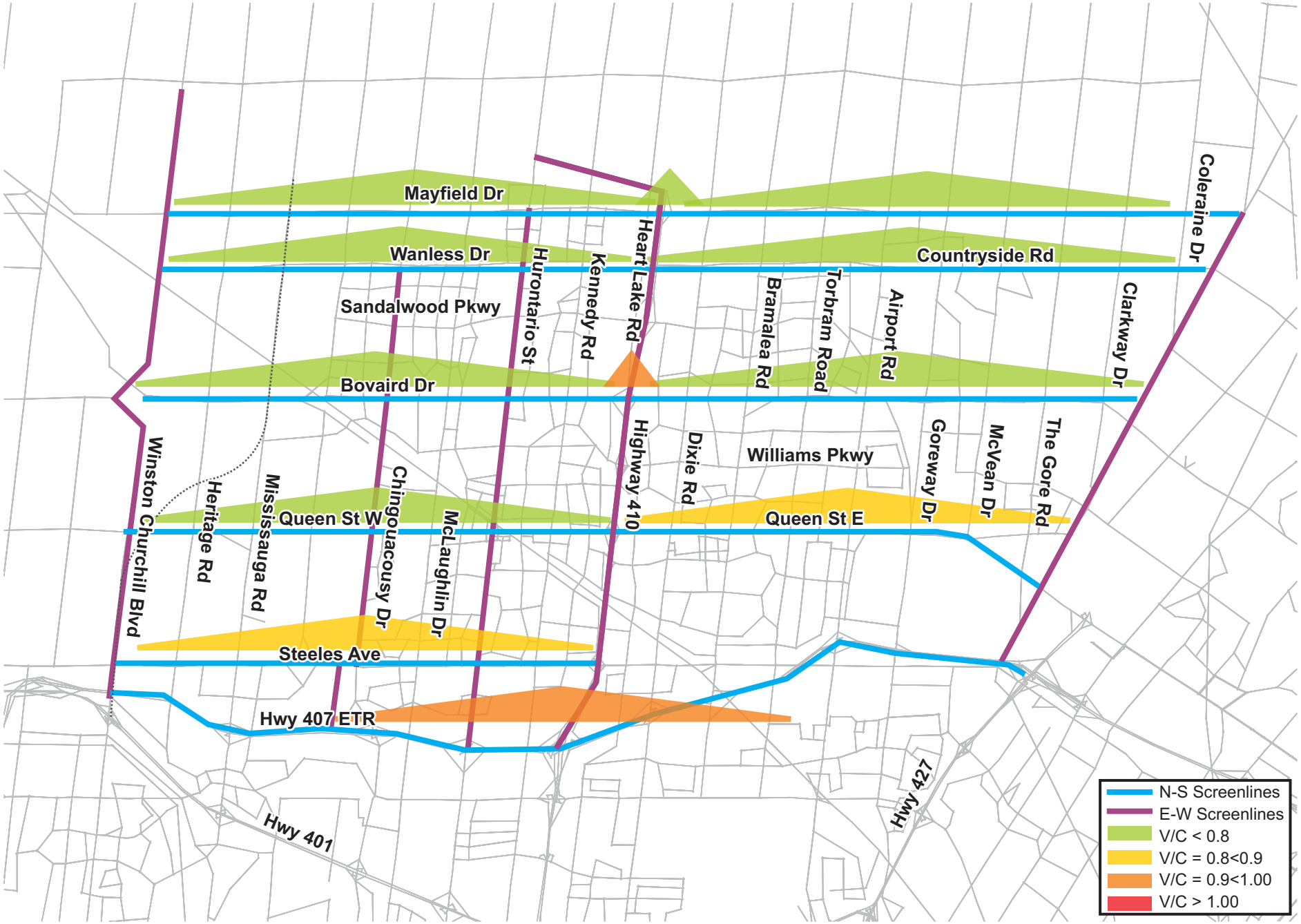


Figure 15 - Screenline Analysis of Alternative 7 - Northbound, P.M. Peak Hour

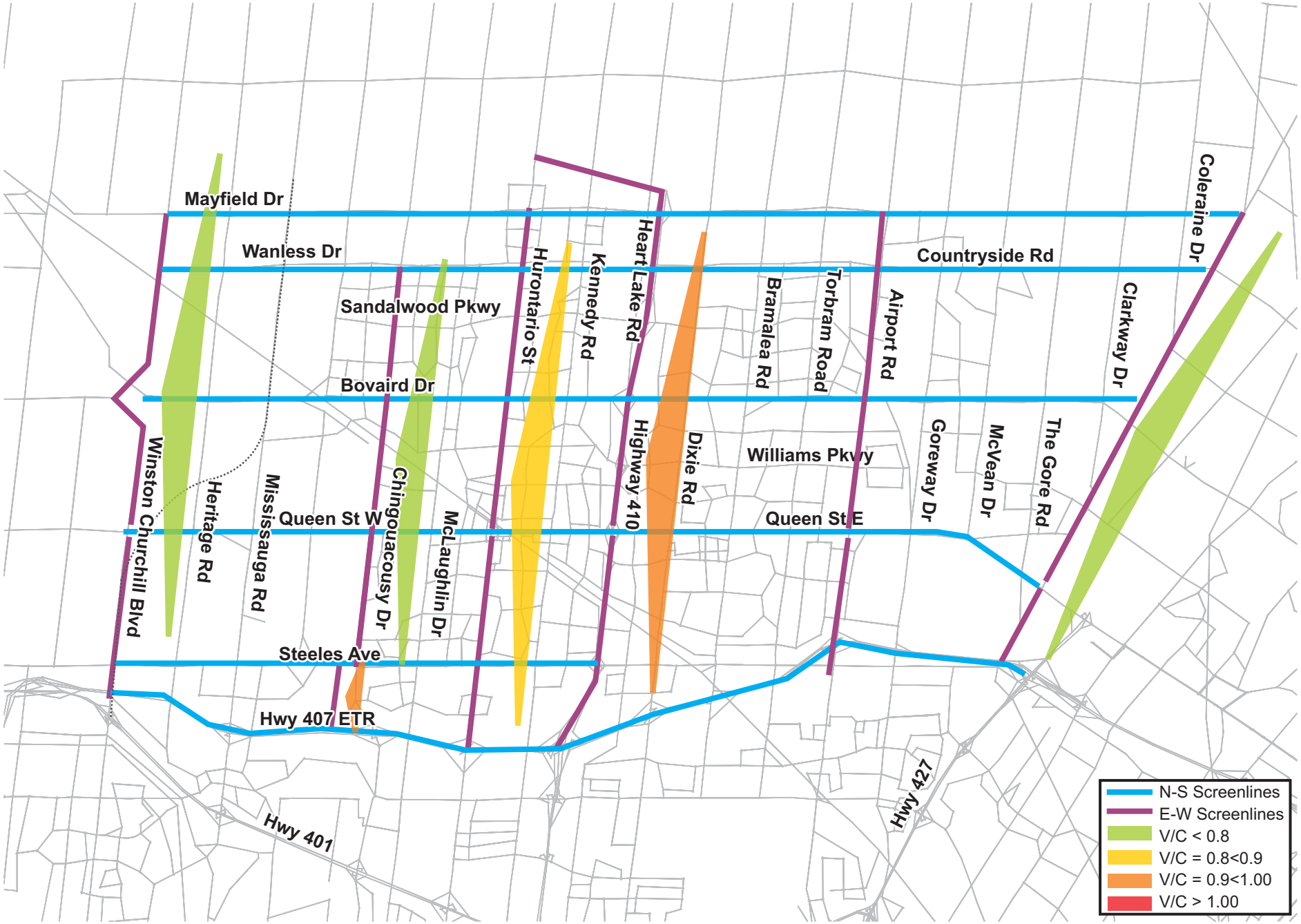


Figure 16 - Screenline Analysis of Alternative 7 - Westbound, P.M. Peak Hour

6. ANALYSIS OF THE PREFERRED ALTERNATIVE

Alternative 7 was selected as the preferred alternative for the 2041 road network. This alternative provides flexibility for the City road network by allowing future conversion of travel lanes into high occupancy vehicle or transit only lanes. The assumptions and detailed analysis of this preferred alternative are provided in this section.

6.1 Assumptions

The following network assumptions were made and incorporated into the travel demand model for the year 2041 preferred alternative:

- **Construction of the GTA West Corridor**: The GTA West corridor will be constructed and operational. This highway will have a beneficial impact on arterial roads in Brampton, diverting some inter-city trips that would have been on arterial roads to the highway;
- **Highway 427 Extension**. Highway 427 will be extended to the north and will connect with the GTA West highway;
- **Highway 410 Widening:** The section of Highway 410 between Highway 401 and Bovaird Drive will be widened to 8 lanes. North of Bovaird Drive, the highway will be 6 lanes;
- **Construction of East-West Corridor based on Halton Peel Boundary Area Transportation Study (HPBATS):** The east-west connection between Highway 7/Bovaird Drive and Winston Churchill Boulevard at 10side road was assumed in the 2041 model as proposed in the HPBATS study;
- **BRT/LRT Corridors**. BRT/LRT lines will be implemented by 2041 on the following five corridors with reduced lane capacity (by 100 vehicles per hour per lane): Bovaird Drive from Mississauga Road to Airport Road, Queen Street from Mississauga Road connecting to Highway 7 VIVA BRT, Steeles Avenue from Lisgar GO station to Humber College, Mississauga Road from Bovaird Drive to Erin Mills Parkway, Airport Road from Bovaird Drive to Pearson Airport; and
- **LRT Corridor:** The LRT line to be implemented by 2041 is the Hurontario / Main Street LRT from Queen Street to Port Credit
- **Number of Lanes**: Road widening will be capped at six through lanes for all roads in the City.

The following modelling assumptions were considered during modelling process:

- **Local Transit Mode Split**: It was assumed that a 16% local transit mode split could be achieved by the year 2041. This assumption has been carried through the transit planning undertaken in this project, and summarized in Technical Report #4 – Future Transit Provisions.
- **BRT/LRT Operation**. BRT/LRT lines were assumed to operate at 20 km per hour with 5 minutes' headway during peak period.

6.2 Multiple Account Evaluation of Projects in the Preferred Alternative

To begin the alternatives assessment of the preferred alternative (Alternative 7), a multiple account evaluation (MAE) framework was established. The MAE was created recognizing that traditionally, road network performance has been evaluated almost exclusively from the perspective of the private automobile. Recommendations primarily involve widening roads on which congestion is predicted. Such improvements attract greater numbers of vehicles, filling the extra capacity generated by the widening and increasing congestion on connecting roads. This approach encourages drivers to travel greater distances thus promoting urban sprawl, and discourages consideration of more sustainable travel modes such as transit and active transportation.

Among the City of Brampton's goals for this TMP Update is to continue to establish and expand a sustainable, integrated multi-modal transportation system that reduces reliance upon any single mode, particularly the automobile, and promotes walking, cycling and transit. In line with this, potential road improvements have been filtered using the MAE approach. Benefits of this approach include:

- Identifying road network benefits for active transportation, transit and goods movement;
- Recognizing the need for appropriate network connectivity for effective routing choices;
- Supports congestion relief in a sub-area of the City; and
- Protects the natural environment through limiting further transportation impacts to natural areas.

The accounts are described as follows:

- **Rationalizes Network** – Rationalization stands for ensuring that lane-cross sections across the corridor are consistent with the intent to improve traffic operations and not create pinch-points. This applies to projects that fill gaps in the City road network and thus have the potential to shorten the distance travelled between origins and destinations.
- **Support for Transit** – Assumption is that a 6-lane widening even though not along a BRT corridor will improve transit operations by reducing congestion in the corridor. Further, the usage of the 6-lane corridors can be adjusted to allow 2 lanes to be used for HOV/Buses only in the future. Further, consideration was given to the density and intensification targets highlighted in the City's Official Plan, which should be supported by transit. This account also recognizes improvements to the higher order transit network and transit access to mobility hubs will help support land intensification.
- **Goods Movement** – This account recognizes where improvements are proposed on roads that are identified in the Peel Region Strategic Goods Movement Network and roads that link these corridors to major employment areas. An effective goods movement network is essential to the City maintaining and enhancing its leading position in the goods movement industry in Canada. If a corridor improvement lies in a proposed freight corridor, the road improvement would be given a positive score on this evaluation criterion.
- **Congestion Relief** – Volume-to-capacity plots (alternative with a 16% mode split and mixed BRT) at the link level were used to visually identify congestion in the corridor under question and in corridors parallel to itself. If the v/c ratio exceeds 0.85 along a number of links in the corridor and its parallel routes than this proposed improvement would be beneficial

- **Environmental Impact** – This assessment identifies the natural areas adjacent to the proposed road improvements. Road projects that avoid infringement on natural areas are scored higher than those that do infringe.

These accounts were further supplemented by some additional factors:

- **Horizon Year 2041**: The first four alternatives attempted to make do with the planned road improvements identified in the 2009 TTMP and did not include any additional improvement not identified in this document. However, the modelling confirmed the 2031 TTMP recommendations and, by extending the horizon year from 2031 to 2041 and including the forecast additional population and employment growth, it became apparent that additional transportation projects needed to be considered;
- **Development Charges Study work**: The MAE approach is based on system optimization. However, this approach can also lead to a system that operates at a high degree of efficiency, but very limited redundancy. Given the need to build some redundancy in the system and the limited opportunity to include projects in the Development Charges By-law, it would be imprudent of the City to limit the road network at this time in the face of the forecast population growth;
- **Need for Transit**: Transit will need to play a larger role as a mobility solution in Brampton. The existing Development Charges By-law is limited in its ability to collect for transit improvements. Roads have been widened to four or six lanes in order to better accommodate transit and also to give the City flexibility in the future to consider converting lanes to high occupancy vehicle lanes or even transit-only lanes;
- **Capacity**: Capacity concerns are prevalent throughout the City. While a multi-modal future with a more balanced mode split is desired, the City must acknowledge the role of automobiles and trucks and the need for adequate vehicular capacity; and
- **Connectivity**: Some lanes may need to be widened to complete the travel grid and provide receiving lanes for left turn lanes.

6.3 New Road Projects Tested for the Preferred Alternative

There were 12 new road projects considered for inclusion in the 2041 preferred alternative, in addition to those projects already identified in the 2009 TTMP, as well as projects identified in northwestern Brampton, that are subject to area-specific studies. In addition, the analysis focused on the 2031 proposed First Gulf Crossing of Highway 410 in order to confirm its importance to the road network. Some of the road projects tested include Regional Roads within the City. The Regional Roads were added to the model in order to determine the overall performance of the road network with the City. Regional improvements will need to be reconfirmed by Peel Region when the Regional TMP is updated for the 2041 horizon year. The new road projects tested for inclusion in the preferred alternative are listed in **Table 6**.

Table 6: New Road Projects Tested for Inclusion in the Preferred Alternative

Road	Jurisdiction	From	To
Mayfield	Peel Region	Winston Churchill	Mississauga
Chinguacousy	City of Brampton	Wanless	Mayfield
Conservation	City of Brampton	Hurontario	Kennedy
Kennedy	Peel Region	Williams Pkwy	Bovaird
Dixie	Peel Region	Countryside	Mayfield
Torbram	City of Brampton	Countryside	Mayfield
Airport	Peel Region	Stonecrest	Mayfield
The Gore	Peel Region	Countryside	Mayfield
Ebenezer	City of Brampton	Queen	Hwy 50
Confirm First Gulf Crossing	City of Brampton	Across Highway 410	
McLaughlin	City of Brampton	Steeles	Queen
Mississauga	Peel Region	Sandalwood	Mayfield

6.4 Technical Analysis

Each of the road projects was analyzed using the multiple account evaluation (MAE) framework. Volume to capacity ratios on individual road segments and on adjacent road segments were analyzed to determine the effectiveness of the proposed new road projects. Analysis of screenline plots also was undertaken to support the capacity analysis. The complete spreadsheet showing the evaluation of each road project given the two approaches is provided in **Appendix A**. The summary of the analysis is included in **Table 7**.

Table 7: Technical Analysis of New Road Projects for Inclusion in 2041 Preferred Road Network

Road	From	To	Improvement	Meets Multiple Account Evaluation Threshold	Meets Capacity Threshold
Mayfield	Winston Churchill	Mississauga	6 lanes	**Yes**	No
Chinguacousy	Wanless	Mayfield	6 lanes	**Yes**	No
Conservation	Hurontario	Kennedy	4 lanes	No	**Yes**
Kennedy	Williams Pkwy	Bovaird	6 lanes	**Yes**	**Yes**
Dixie	Countryside	Mayfield	6 lanes	**Yes**	**Yes**
Torbram	Countryside	Mayfield	6 lanes	**Yes**	No
Airport	Stonecrest	Mayfield	6 lanes	**Yes**	No
The Gore	Countryside	Mayfield	6 lanes	No	No
Ebenezer	Queen	Hwy 50	6 lanes	No	**Yes**
First Gulf Crossing	Across Highway 410		0 to 4 lanes	No	**Yes**
McLaughlin	Steeles	Queen	6 lanes	No	**Yes**
Mississauga	Sandalwood	Mayfield	6 lanes	**Yes**	**Yes**

All road projects with the exception of the Gore Road between Countryside and Mayfield met at least one of the two thresholds.

6.5 Road Projects Included in the Preferred Alternative

At the conclusion of the technical analysis, the project team undertook detailed review of the results. Through dialogue, it was concluded that even though Conservation Drive between Hurontario Street and Kennedy Road met the capacity threshold, it should not be widened due to natural environment concerns. These concerns were part of the reason that the project did not meet the natural environment criterion in the multiple account evaluation.

At the same time, even though the Gore Road did not meet the multiple account evaluation threshold or the capacity threshold, it was decided to include the widening of the Gore Road between Countryside Drive and Mayfield Road, as this was seen as an important link in the arterial road network and would be needed for adequate connectivity.

The First Gulf crossing of Highway 410 met the capacity threshold but did not meet the MAE threshold. Considering other factors other than solely capacity, such as the high cost implications of the crossing, and in consultation with stakeholders, it was decided that this crossing of Highway 410 should be removed from the preferred alternative.

Further review of the model output revealed that Williams Parkway should be widened between Highway 410 and Torbram Road due to capacity constraints on this road and collector roads such as Howden Boulevard and Park Drive.

Even though the GTA West highway was assumed to be constructed for the year 2041, it will be located about 8 kilometres north of Williams Parkway and would have less influence on Williams Parkway traffic volumes.

Exhibit 2 in **Appendix B** shows the 2041 volume to capacity (v/c) ratios for Williams Parkway from North Park Drive to Torbram Road. There is one segment with v/c ratio of 0.95, followed by 0.83 and 0.82 for the second and third segments.

A screenline east of Highway 410 from Mayfield Road to Highway 407 is included in the analysis. The 2041 screenline v/c ratio for eastbound and westbound movements are 0.75 and 0.91, respectively (please see Exhibit 2 and Exhibit 3 in Appendix B). It is noted that Williams Parkway at this screenline has 6 through lanes (between Highway 410 and North Park Drive). The Williams Parkway screenline analyses for the years 2031 and 2041 are included in Appendix B.

The new road projects included in the 2041 preferred alternative are summarized in **Table 8**. The location of these road projects are highlighted in **Figure 17**.

Table 8: New Road Projects Included in the 2041 Preferred Alternative

Road	From	To	Improvement
Mayfield	Winston Churchill	Mississauga	6 lanes
Chinguacousy	Wanless	Mayfield	6 lanes
Kennedy	Williams Pkwy	Bovaird	6 lanes
Dixie	Countryside	Mayfield	6 lanes
Torbram	Countryside	Mayfield	6 lanes
Airport	Stonecrest	Mayfield	6 lanes
The Gore	Countryside	Mayfield	6 lanes
Ebenezer	Queen	Hwy 50	6 lanes
McLaughlin	Steeles	Queen	6 lanes
Mississauga	Sandalwood	Mayfield	6 lanes
Williams Pkwy	Highway 410	Torbram	6 lanes

Analysis of north-south screenlines with these projects in place shows capacity pressure in the southern portion of the city. East-west screenline analysis shows capacity pressures in the central portion of the city, extending to the southeastern corner. The screenline analyses of north-south and east-west screenlines are provided in **Figure 18** and **Figure 19**, respectively. The volume to capacity output plot from the travel demand model is provided in **Figure 20**. The ultimate road network for the 2041 horizon year is shown in **Figure 21**.

MAYFIELD
MISSISSAUGA
CHINGUACOUSY RD
BOVAIRD
HURONTARIO
KENNEDY
DIXIE
SANDALWOOD PARKWAY
TORBRAM
AIRPORT
GOREWAY
MCVEAN
THE GORE
HIGHWAY 50
WILLIAMS PARKWAY
HWY 410
QUEEN
EBENEZER RD
WINSTON CHURCHILL
HERITAGE
MCLAUGHLIN RD S
BRAMALEA
STEELES
HWY 407

To develop formal plans for specific road improvements, environmental assessment studies will need to be carried out and approved through the EA process.

2 1 0 2 Km

Pathway: J:\01 PROJECTS\2013 jobs\16-13074.DBR (Brampton TMP)\Network Mapping\iii. Mapping\ii. MXD Files\i. Road Network

BRAMPTON Flower City
Transportation Master Plan

MMM GROUP

Legend

- City Road Expanded to Four Lanes
- Regional Road Expanded to Four Lanes
- Provincial Highway
- City Road Expanded to Six Lanes
- Regional Road Expanded to Six Lanes
- Conceptual Road Network for use in the Development Charges Background Study

Figure 17
New Road Projects Included in the 2041 Preferred Alternative

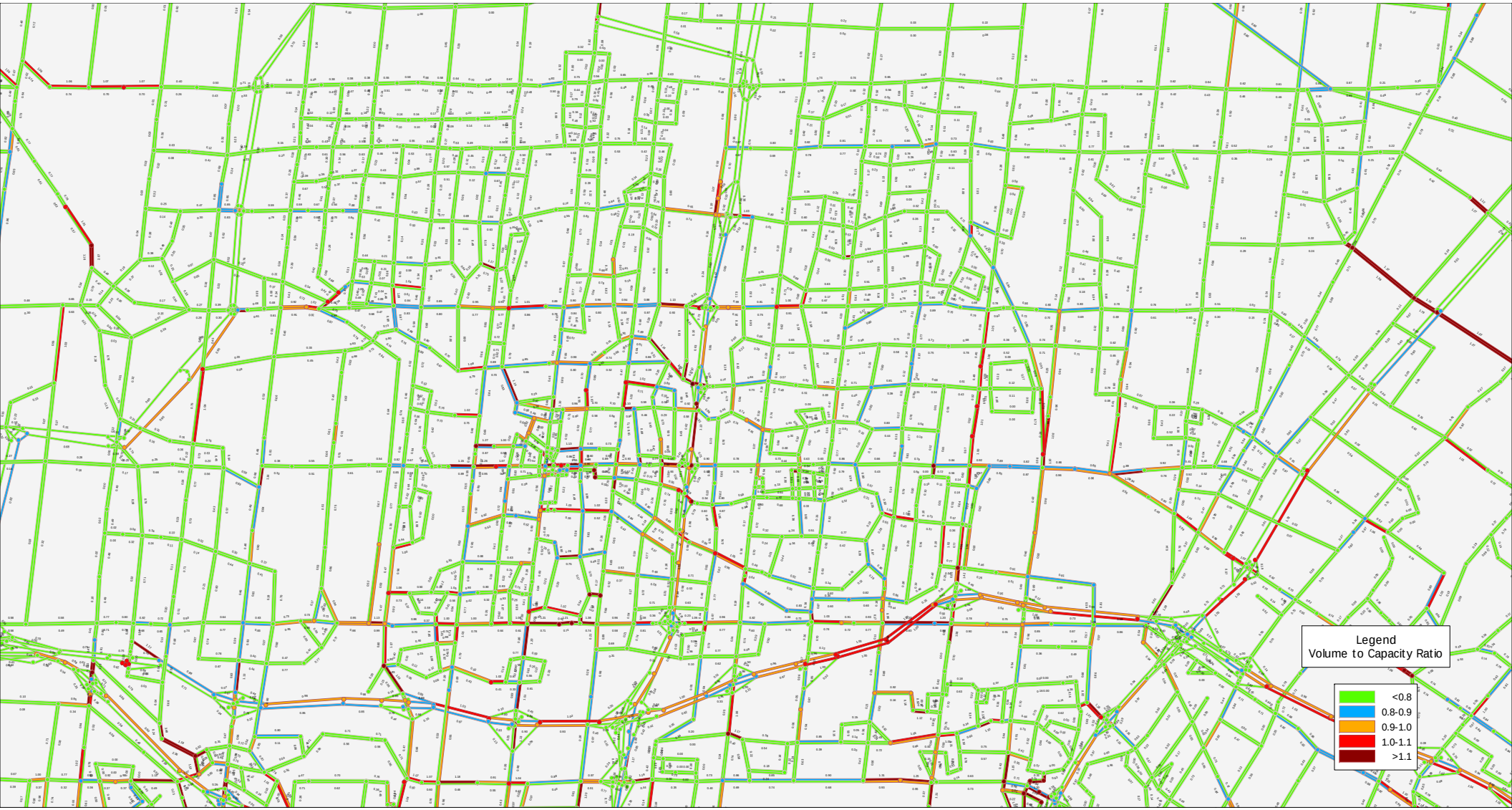
Figure 18: North-south Screenline Analysis of Preferred Alternative

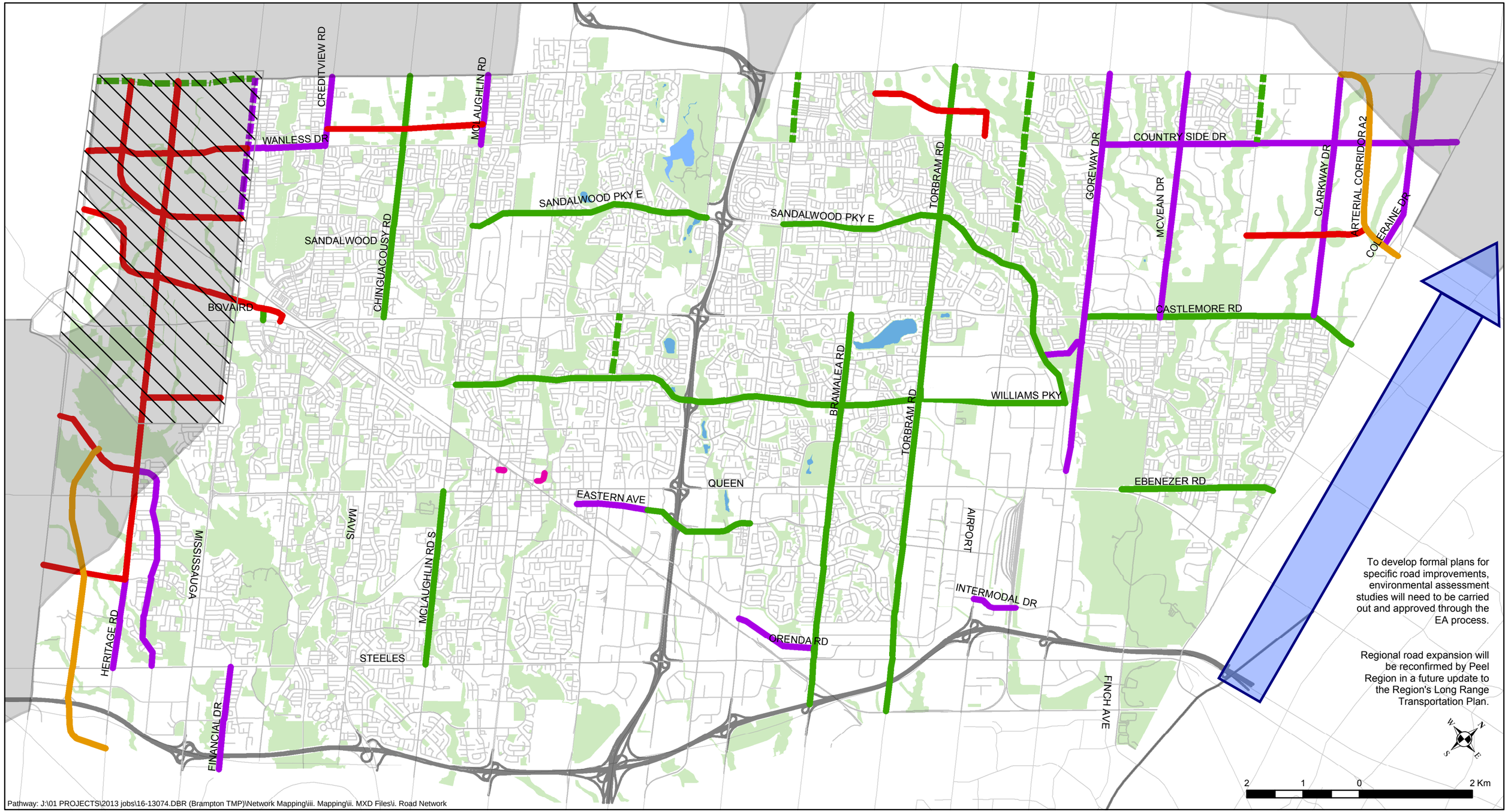
2041 Transit Focus - 6 Lane BRT
North-South Traffic

Figure 19: East-west Screenline Analysis of Preferred Alternative

2041 Transit Focus - 6 Lane BRT
East-West Traffic

Figure 20: Volume to Capacity Plot of Preferred Alternative





Pathway: J:\01 PROJECTS\2013 jobs\16-13074.DBR (Brampton TMP)\Network Mapping\iii. Mapping\ii. MXD Files\i. Road Network

BRAMPTON Flower City | Transportation Master Plan

MMM GROUP

Legend

- City Road Expanded to Four Lanes
- City Road Expanded to Four Lanes
- City Road Expanded to Six Lanes
- Regional Road Expanded to Six Lanes
- City Road Extension by Two Lanes
- New Road Construction Six Lanes
- New Road Construction Four Lanes
- Provincial Highway
- GTA West Corridor Study Area
- Highway 427 and Extension
- Conceptual Road Network for use in the Development Charges Background Study

Figure 21
Recommended City Road Network Needs to 2041

7. TRANSIT PROJECTS INCLUDED IN THE PREFERRED ALTERNATIVE

Concurrent with the development of the future road network was the planning for the continued development and expansion of the transit network. Described in detail in Technical Report #4 – Future Transit Provisions, the future transit network identifies new higher order rapid transit corridors and the expansion of the City's ZÜM bus service. By 2041, higher order rapid transit is planned for Hurontario / Main Street and Queen Street, with ZÜM bus service on major north-south and east-west arterial roads. The transit network for the preferred alternative is shown in **Figure 22**.

MAYFIELD
WANLESS
SANDALWOOD
BOVAIRD
STEELES
QUEEN
COUNTRYSIDE
SANDALWOOD PARKWAY
WILLIAMS PARKWAY
HURONTARIO
MAIN
MISSISSAUGA
CHINGUACOUSY
MCLAUGHLIN
KENNEDY
DIXIE
TORBRAM
BRAMALEA
AIRPORT
GOREWAY
THE GORE
MCVEAN
FINCH AVE
To Kitchener
Mt. Pleasant GO Station
Downtown Brampton GO Station
To Lisgar GO Station
Bramalea GO Station
To Vaughan Metropolitan Centre
To Humber College
To Toronto
2 1 0 2 Km
J:\01 PROJECTS\2013 jobs\16-13074.DBR (Brampton TMP)\Network Mapping\iii. Mapping\ii. MXD Files\iii. Transit

BRAMPTON Flower City
Transportation Master Plan
MMM GROUP

Legend

- Higher Order Rapid Transit
- ZÜM
- Hurontario / Main LRT
- GO Rail
- Support Corridor
- GO Train Station
- Conceptual Road Network for use in the Development Charges Background Study

Notes:
1. All routes running outside of the City of Brampton will be determined through additional detailed service planning on strategic corridors.

2. Transit services will be provided to new growth areas in Bram West, Northwest Brampton, and Northeast Brampton. Determination of corridor types will be established through the Secondary Planning Process. Connections to key future transit routes outside of Brampton should be provided as required.

3. "Higher Order Transit" are projects identified by Metrolinx in the Big Move.

Figure 22
Recommended Transit Network Needs to 2041

8. CONCLUSION

The development of the preferred road network for the 2015 TMP Update for the City of Brampton has undergone a rigorous dual-faceted analysis. Initially the modelling confirmed the 2031 network recommendations of the 2009 TTMP and identified that additional network and transportation system improvements would be required by 2041 to accommodate the projected employment and population growth. The development of the recommended 2041 network was undertaken within a holistic method, integrating transit system improvements and expansion, and applying two distinct evaluation techniques: MAE and screenline analysis of volume to capacity ratios.

The preferred 2041 road network recognizes maturation of the city and the transportation network. It includes road widenings that may very well be the ultimate build out of the road. These plans are designed to accommodate future traffic for the year 2041 and beyond.

Importantly, the recommended road network positions the City to think seriously about converting lanes to high occupancy vehicle lanes or transit-only lanes. Doing so would help to reach the goal of a 16% local transit modal split and would shift the emphasis from automobiles to other travel options.

Appendix A. Evaluation of New Road Projects in the 2041 Preferred Alternative

Evaluation of New Road Projects in the 2041 Preferred Alternative

Screenline Reference	Project	From	To	Improvement Being Assessed	Rationalizes Network*	Assists and Furthers Primary Transit Corridors**	Assists Freight Movement***	Is it Required to Relieve Congestion in Sub-area (itself and parallel corridors)~~	No Significant Environmental Consideration	16% split and mixed BRT Peak Point v/c ratios in Segment (peak point v/c on adjacent road in segment)	Recommendation (3 or more YES)	Recommendation VC ~ 0.85 (approximation)
31A- Brampton/Halton Westbound	Mayfield Rd	Winston Churchill	Mississauga	6 lanes	Yes	No	Yes	No	Yes	0.71 (0.67)	Yes	No
52A - Caledon boundary - W. Churchill to Heart Lake Northbound	Chinguacousy	Wanless	Mayfield	6 lanes	Yes	Yes	No	No	Yes	0.43 (0.53)	Yes	No
72A - E. of Hurontario Westbound	Conservation	Hurontario	Kennedy	4 lanes	No	No	No	Yes	No	0.76 (0.84)	No	Yes
84A - South of Bovaird - Heritage to South Lake Northbound	Kennedy	Williams Pkwy	Bovaird	6 lanes	No	Yes	Yes	Yes	Yes	0.83 (0.84)	Yes	Yes
52C - Caledon boundary - Dixie to Hwy 50 Northbound	Dixie	Countryside	Mayfield	6 lanes	Yes	Yes	Yes	No	Yes	0.49 (0.91)	Yes	Yes
52C - Caledon boundary - Dixie to Hwy 50 Northbound	Torbram	Countryside	Mayfield	6 lanes	Yes	Yes	No	No	Yes	0.50 (0.66)	Yes	No
52C - Caledon boundary - Dixie to Hwy 50 Northbound and South of Countryside - Dixie to Hwy 50 Northbound	Airport	Stonecrest	Mayfield	6 lanes	Yes	Yes	Yes	No	No	0.66 (0.74)	Yes	No
52C - Caledon boundary - Dixie to Hwy 50 Northbound	The Gore	Countryside	Mayfield	6 lanes	Yes	Yes	No	No	No	0.61 (0.58)	No	No
33B - Brampton/York Westbound	Ebenezer	Queen	Hwy 50	6 lanes	No	No	No	Yes	No	1.21 (1.02)	No	Yes
73- East of Hwy 410 Westbound	First Gulf Crossing	Across 410		0 to 4 lanes	No	No	No	Yes	No	0.57 (1.09)	No	Yes
South of Queen - W. Churchill to Rutherford Northbound	McLaughlin	Steeles	Queen	6 lanes	No	Yes	No	Yes	No	0.89 (0.95)	No	Yes
South of Wanless/Conservation Drive - W. Churchill to Heart Lake Northbound and 52A - Caledon boundary - W. Churchill to Heart Lake Northbound	Mississauga	Sandalwood	Mayfield	6 lanes	Yes	Yes	Yes	No	Yes	0.46 (0.85)	Yes	Yes

* rationalization stands for ensuring that lane-cross sections across the corridor are consistent with the intent to improve traffic operations and not create pinch-points

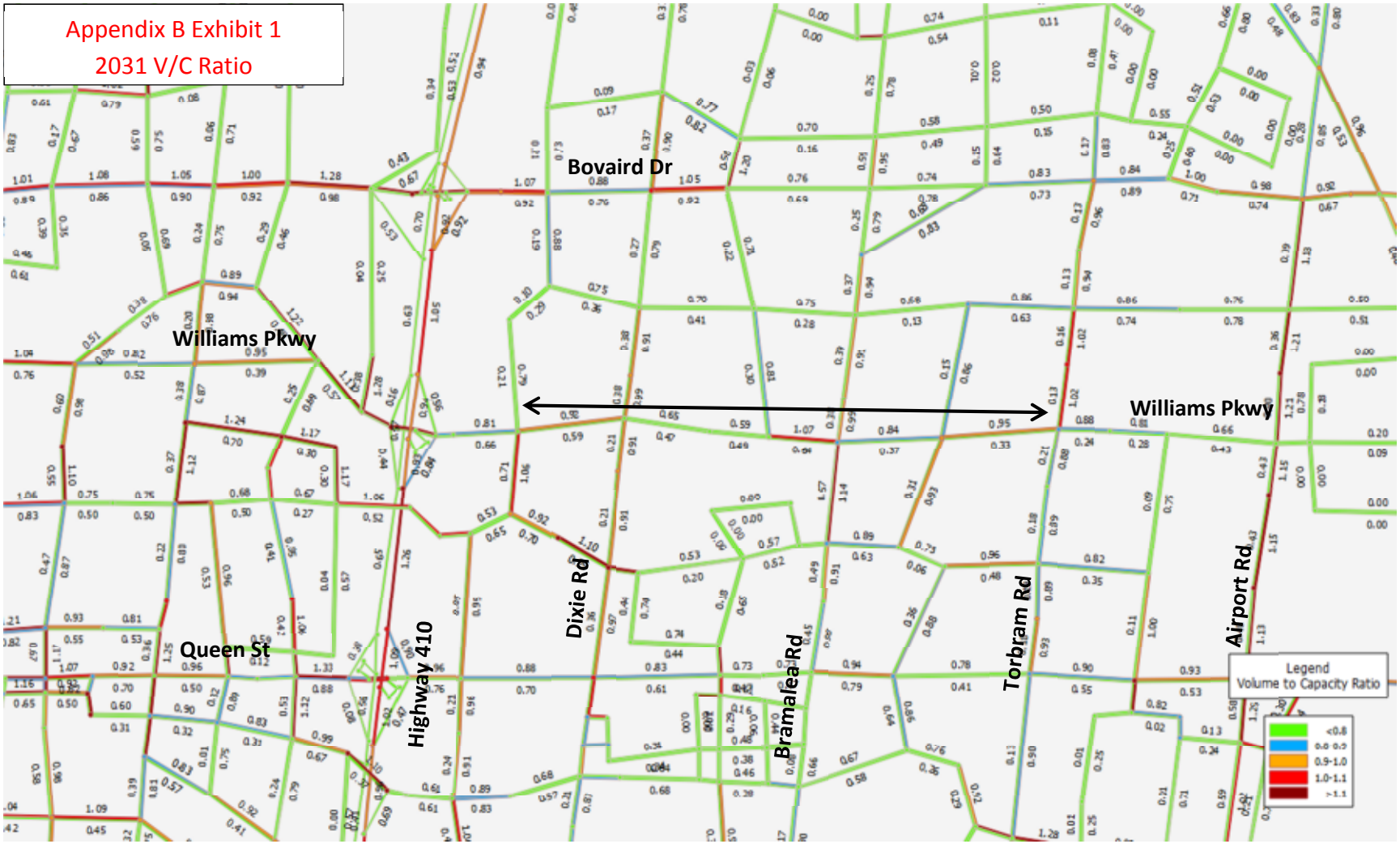
** Assumption is that a 6-lane widening even though not along a BRT corridor will improve transit operations by reducing congestion in the corridor. Further, the usage of the 6-lane corridors can be adjusted to allow 2 lanes to be used for HOV/Buses only

*** If a corridor improvement lies in a proposed freight corridor it is a positive

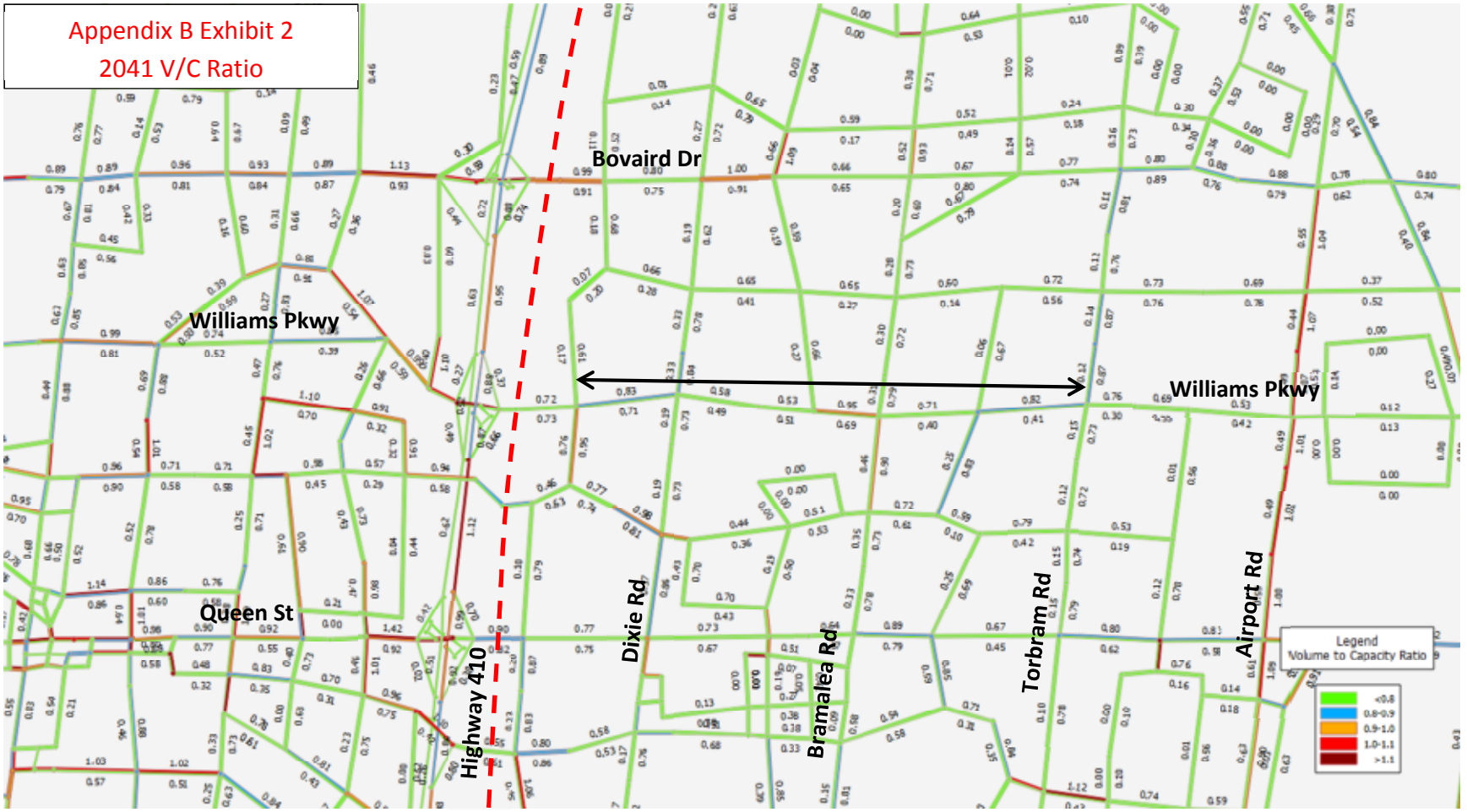
~~ volume-to-capacity plots (scenario with a 16% mode split and mixed BRT) at the link level were used to visually identify congestion in the corridor under question and in corridors parallel to itself. If the v/c ratio exceeds 0.85 along a number of links in the corridor and its parallel routes than this proposed improvement would be beneficial

Appendix B. Williams Parkway Road Widening Analysis

Appendix B Exhibit 1
2031 V/C Ratio



Appendix B Exhibit 2
2041 V/C Ratio



Westbound V/C 0.91

Eastbound V/C 0.75

2041 Screenline East of Highway 410

Appendix B Exhibit 3
2041 Screenline East of Hwy 410

i_j	I Node	J Node	Station	stn#	dir	description	Model Lanes	Model Lane Cap.	Model Capacity	svol_MMM Volume	Screenline VOC
50563_52256	50563	52256	318W	318	W	Mayfield Rd East of Heart Lake Rd	3	800	2400	1886	
50834_50564	50834	50564			W	Countryside Dr east of Hwy 410	2	700	1400	1215	
50845_52268	50845	52268	345W	345	W	Sandalwood Pkwy West of Great Lakes D	3	800	2400	2440	
50570_51374	50570	51374	320W	320	W	Bovaird Dr East of Highway 410	3	800	2400	2377	
50576_51383	50576	51383	321W	321	W	Williams Pakrway East of Highway 410	3	800	2400	1738	
50847_51167	50847	51167	322W	322	W	Vodden Ave East of Highway 410	2	500	1000	894	
50584_51372	50584	51372	323W	323	W	Queen St West of West Dr	3	800	2400	2158	
50586_51405	50586	51405	324W	324	W	Clark Blvd East of Highway 410	3	600	1800	1240	
50592_50818	50592	50818	325W	325	W	Orenda Rd East of Highway 410	2	600	1200	1283	
50822_50816	50822	50816	326W	326	W	Glidden Rd East of Highway 410	2	500	1000	715	
52292_50820	52292	50820			W	New Road	Short connection				
52010_51797	52010	51797			W	New Road	2	500	1000	585	
50318_50548	50318	50548	327W	327	W	Steeles Ave East of Highway 410	3	800	2400	2526	
51833_51677	51833	51677	408W	408	W	Highway 407 East of Highway 410	5	1800	9000	8971	
1815_50562	1815	50562			W						Screenline VC
73- East of Hwy 410 Westbound						**Links with counts**	**36**	**10,000**	**30,800**	**28,028**	0.91
52256_50563	52256	50563	318E	318	E	Mayfield Rd East of Heart Lake Rd	3	800	2400	1145	
50564_50834	50564	50834			E	Countryside Dr east of Hwy 410	2	700	1400	954	
52268_50845	52268	50845	345E	345	E	Sandalwood Pkwy West of Great Lakes D	3	800	2400	1951	
51374_50570	51374	50570	320E	320	E	Bovaird Dr East of Highway 410	3	800	2400	2181	
51383_50576	51383	50576	321E	321	E	Williams Pakrway East of Highway 410	3	800	2400	1746	
51167_50847	51167	50847	322E	322	E	Vodden Ave East of Highway 410	2	500	1000	522	
51372_50584	51372	50584	323E	323	E	Queen St West of West Dr	3	800	2400	1959	
51405_50586	51405	50586	324E	324	E	Clark Blvd East of Highway 410	3	600	1800	1142	
50818_50592	50818	50592	325E	325	E	Orenda Rd East of Highway 410	2	600	1200	876	
50816_50822	50816	50822	326E	326	E	Glidden Rd East of Highway 410	2	500	1000	526	
50820_52292	50820	52292			E	New Road	Short connection				
51797_52010	51797	52010			E	New Road	2	500	1000	95	
50548_50318	50548	50318	327E	327	E	Steeles Ave East of Highway 410	3	800	2400	1663	
51675_51834	51675	51834	408E	408	E	Highway 407 East of Highway 410	5	1800	9000	8254	
50562_1815	50562	1815			E						Screenline VC
73- East of Hwy 410 Eastbound						**Links with counts**	**36**	**10,000**	**30,800**	**23,014**	0.75